4.2.7.2 Wetlands

A 1996 field survey identified an estimated 20 hectares (50 acres) of wetlands within LANL. The LANL survey determined that more than 95 percent of the identified wetlands are located in the Sandia, Mortandad, Pajarito, and Water Canyon watersheds.

Wetlands in the general LANL region provide habitat for reptiles, amphibians, and invertebrates (e.g., insects), and potentially contribute to the overall habitat requirements of a number of Federal- and state-listed species. The majority of the wetlands in the area are associated with canyon stream channels or are present on mountains or mesas as isolated meadows containing ponds or marshes, often in association with springs or seeps. There are also some springs bordering the Rio Grande within White Rock Canyon. Cochiti Lake, located downstream from LANL, supports lake-associated wetlands.

Currently, about 5 hectares (13 acres) of wetlands within LANL boundaries are caused or enhanced by process effluent wastewater from 21 NPDES-permitted outfalls. These artificially created wetlands are afforded the same legal protection as wetlands that stem from natural sources. In 1996, the effluent from NPDES outfalls, both storm water and process water, contributed 108 million gallons (407 million liters) to wetlands within LANL boundaries, and nearly half of the outfalls are probable sources of drinking water for large mammals.

During the Cerro Grande Fire, 6.5 hectares (16 acres), or 20 percent of the wetlands occurring on LANL, were burned at a low or moderate intensity. No wetlands within LANL were severely burned. Secondary effects from the fire to wetlands may also occur as a result of increased runoff due to the loss of vegetation. Wetlands were not disturbed by fire suppression activities; however, a number of projects were undertaken after the Cerro Grande Fire to control runoff and erosion. Two projects involving the enlargement of culverts in lower Pajarito Canyon, one about 0.4 kilometers (0.25 miles) downstream from TA-18 and the other at State Road 4, resulted in removal of about 0.6 hectares (1.5 acres) of wetland vegetation composed primarily of willow trees. Wetland vegetation is likely to regenerate over the next several years if the area is not silted in or scoured away by floodwaters (DOE 2000h).

There is one wetland located at the eastern end of TA-18. This wetland results from manmade sources and is characterized by riparian vegetation. Wetland plant species present include rush, willow, and broad-leafed cattail. Animals observed using this wetland include the many-lined skink, western chorus frog, red-winged blackbird, violet-green swallow, long-tailed vole, and vagrant shrew.

There are three wetlands located within TA-55. These wetlands result from natural sources and are characterized by vegetation and faunal components similar to those found in the wetland associated with TA-18.

4.2.7.3 Aquatic Resources

While the Rito de Los Frijoles in Bandelier National Monument (located to the south of LANL) and the Rio Grande are the only truly perennial streams in the region. Several of the canyon floors on LANL contain reaches of perennial surface water, such as the perennial streams draining lower Pajarito and Ancho Canyons to the Rio Grande. Surface water flow occurs in canyon bottoms seasonally, or intermittently, as a result of spring snowmelt and summer rain. A few short sections of riparian vegetation of cottonwood, willow, and other water-loving plants are present in scattered locations on LANL, as well as along the Rio Grande in White Rock Canyon. The springs and streams at LANL do not support fish populations; however, many other aquatic species thrive in these waters (DOE 1996g). Terrestrial wildlife use onsite streams for drinking and associated riparian habitat for nesting and feeding.

There are no aquatic resources located in either TA-18 or TA-55.

4.2.7.4 Threatened and Endangered Species

There are four agencies that have authority to designate threatened, endangered, and sensitive species in New Mexico. The agencies are the U.S. Fish and Wildlife Service (USFWS), the New Mexico Game and Fish Department, the New Mexico Forestry and Resource Conservation Division, and the U.S. Forest Service. The State of New Mexico separates the regulatory authority for plants and animals between the Forestry and Resource Conservation Division and the Game and Fish Department, respectively. The U.S. Forest Service lists species for special management consideration on lands under their jurisdiction and protects these species under the authority of the Endangered Species Act of 1973.

A number of regionally protected and sensitive (rare or declining) species have been documented in the LANL region (see **Table 4–7**). These consist of 2 federally endangered species (the whooping crane and southwestern willow flycatcher), 2 federally threatened species (the bald eagle and Mexican spotted owl), and 18 species of concern (species that may be of concern to USFWS but do not receive recognition under the Endangered Species Act, and that the USFWS encourages agencies to include in NEPA studies). Species listed as endangered threatened, rare, or sensitive by the State of New Mexico are also included in Table 4–7. The New Mexico "sensitive" taxa are those taxa that deserve special consideration in management and planning, and are not listed as threatened or endangered by the State of New Mexico. In addition, critical habitat for the threatened Mexican spotted owl has been designated on Santa Fe National Forest lands that are contiguous with LANL's western boundary.

As mentioned in Section 4.2.7.2, there is one wetland at TA-18. Threatened and endangered species and species of concern that are associated with this type of wetland and which may be found in the vicinity include the Northern goshawk which is listed as a species of concern, the federally threatened Mexican spotted owl, the state threatened spotted bat, the Federally endangered southwestern willow flycatcher, and the checkered lily, which is also listed as a species of concern.

There are three wetland locations within TA-55. These wetlands are similar in vegetation and components to the one at TA-18 and therefore the same threatened and endangered species and species of concern may be found in the vicinity of any of the wetlands within TA-55.

In addition, both TA-18 and TA-55 contain core and buffer Areas of Environmental Interest for the Mexican spotted owl. Areas of Environmental Interest are established under LANL's Habitat Management Plan (LANL 1998) and are areas within LANL that are being managed and protected because of their significance to biological or other resources. Habitats of threatened and endangered species that occur or may occur at LANL are designated as Areas of Environmental Interest. In general, an Area of Environmental Interest consists of a core area that contains important breeding or wintering habitat for a specific species and a buffer area around the core area. The buffer protects the area from disturbances that would degrade the value of the core area to the species.

The results of the Cerro Grande Fire likely will not cause a long-term change to the overall number of federally listed threatened and endangered species inhabiting the region. However, the results of the fire likely will change the distribution and movement of various species, including the Mexican spotted owl. The areas off LANL that have been proposed as critical habitat suffered heavy damage during the Cerro Grande Fire. Specifically, two primary areas considered as critical habitat for the Mexican spotted owl located on Forest Service land near LANL suffered almost 100 percent vegetation mortality. The fire may also have long-term effects on the habitat of several state-listed species, including the Jemez Mountains salamander. As noted in Section 4.2.7.2, two projects undertaken after the fire to enlarge culverts in the lower Pajarito

Canyon disturbed about 0.6 hectares (1.5 acres) of wetland vegetation composed primarily of willow trees. This wetland habitat was part of the habitat area used by the southwestern willow flycatcher at LANL, however, it was not a confirmed nesting habitat and was of marginal quality (DOE 2000h).

Table 4–7 Listed Threatened and Endangered Species, Species of Concern, and Other Unique Species That Occur or May Occur at LANL

Species	*Federal Classification*	*State Classification*	*Occurrence on LANL*
Mammals			
Big free-tailed bat	Special Concern	Special Concern	Migratory visitor
Fringed myotis	Special Concern	Special Concern	Observed on LANL, BNM, and SFNF lands
Goat peak pika	Special Concern	Special Concern	Observed on LAC and BNM lands
Long-eared myotis	Special Concern	Special Concern	Summer resident
Long-legged myotis	Special Concern	Special Concern	Summer resident
New Mexico jumping mouse	Special Concern	Threatened	Permanent resident on LAC and SFNF lands
Occult little brown bat	Special Concern	Special Concern	Observed on SFNF lands
Pale Townsend's big-eared bat	Special Concern	Special Concern	Observed on LANL and BNM lands
Small-footed myotis	Special Concern	Special Concern	Observed on LANL, BNM, and SFNF lands
Spotted bat	Special Concern	Threatened	Permanent resident on BNM and SFNF lands; Seasonal resident on LANL
Yuma myotis	Special Concern	Special Concern	Summer resident
Birds			
American peregrine falcon	Special Concern	Threatened	Forages on LANL
Baird's sparrow	Special Concern	Threatened	Observed on SFNF lands
Bald eagle	Threatened	Threatened	Winter visitor
Ferruginous hawk	Special Concern	Protected	Observed as a breeding resident
Gray vireo	Special Concern	Threatened	Observed on LAC, BNM, and SFNF lands
Loggerhead shrike	Special Concern	Special Concern	Observed on LAC, BNM, and SFNF lands
Mexican spotted owl	Threatened	Special Concern	Breeding resident on LANL, LAC, BNM, and SFNF lands; Critical habitat designated on SFNF lands
Northern goshawk	Special Concern	Special Concern	Observed as a breeding resident
Southwestern willow flycatcher	Endangered	Endangered	Potential presence on LANL and White Rock Canyon; Potential nesting area on LANL; Present in Jemez Mountains; Present in riparian zone near Española
White-faced ibis	Special Concern	Unlisted	Summer resident
Whooping crane	Endangered	Endangered	Migratory visitor along the Rio Grande and Cochiti Lake
Amphibians			
Jemez Mountain salamander	Special Concern	Threatened	Permanent resident
Fish			
Flathead chub	Special Concern	Unlisted	Permanent resident of the Rio Grande between Española and the Cochiti Reservoir
Plants			
Checkered lily	Unlisted	Special Concern	Observed on LAC, BNM, and SFNF lands
Helleborine orchid	Unlisted	Special Concern	Rare
Wood lily	Unlisted	Endangered	Observed on LAC, BNM, and SFNF lands
Yellow lady's slipper orchid	Unlisted	Endangered	Observed on BNM lands

LAC = Los Alamos County; BNM = Bandelier National Monument; SFNF = Sante Fe National Forest
Source: DOE 1999b.

4.2.8 Cultural and Paleontological Resources

4.2.8.1 Prehistoric Resources

Prehistoric resources at LANL refer to any material remains and items used or modified by people before the establishment of a European presence in the upper Rio Grande Valley in the early seventeenth century. Archaeological surveys have been conducted of approximately 75 percent of the land within LANL (with 60 percent of the area surveyed receiving 100 percent coverage) to identify the cultural resources present. The majority of these surveys emphasized prehistoric Native American cultural resources, including pueblos, rock shelters, rock art, water control features, trails, and game traps. A total of 1,295 prehistoric sites has been recorded on LANL, of which 1,192 have been assessed for potential nomination to the National Register of Historic Places. Of these, 770 sites were determined to be eligible, 322 sites potentially eligible, and 100 sites ineligible. The remaining 103 sites, which have not been assessed for nomination to the National Register of Historic Places, are assumed to be potentially eligible until assessed. Two areas in the vicinity of LANL have been established as National Register of Historic Places sites or districts: Bandelier National Monument (named as a monument in 1916) and Puye Cliffs Historical Ruins (DOE 1996g).

Cerro Grande Fire affected 304 prehistoric sites; however, impacts to these sites are not fully known. Potential impacts could result from burned out tree root systems forming conduits for modern debris and water to mix with subsurface archaeological deposits and may provide an entry point for burrowing animals. Also, snags or dead or dying trees may fall and uproot artifacts (DOE 2000h). Areas at LANL burned by the Cerro Grande Fire will be surveyed for impacts over the next several field seasons.

TA-18 contains two prehistoric cultural resources. One site is comprised of approximately 40 prehistoric cavates (i.e., man-made rooms excavated in the tuff cliff faces of canyon walls). This complex of cavates was occupied discontinuously starting in the Coalition period and as late as the Post-Pueblo Revolt period. The second site is a rock shelter of undetermined Pueblo period age. Both sites have been determined eligible for the National Register of Historic Places by the New Mexico State Historic Preservation Office.

TA-55 contains one prehistoric lithic scatter that the New Mexico State Historic Preservation Office has determined is not eligible for the National Register of Historic Places.

4.2.8.2 Historic Resources

Historic resources present within LANL boundaries and on the Pajarito Plateau can be attributed to three phases: Spanish colonial, early U.S. territorial/statehood, and the nuclear energy period. Because of the very well-defined changes in the function of LANL, the nuclear energy period is further broken into three periods: World War II/early nuclear weapon development, early cold war, and late cold war. The numbers of artifacts or sites identified from each period are as follows: 0 from the Spanish colonial period, 87 from the early U.S. territorial/statehood period, 515 from World War II/early nuclear weapon development and early cold war periods, and 1,717 from the late cold war period; Thus, a total of 2,319 historic artifacts or sites has been identified at LANL. Of these, 214 have been recorded through site surveys. The remaining 2,105 resources were identified by reviewing the construction dates presented in a number of LANL documents and the site cultural resources database.

The Cerro Grande Fire affected 58 historic sites; some resources were severely impacted. Many wooden structures from the homestead era and from the Manhattan Project/cold war period and various Manhattan Project artifacts were adversely affected. The fire destroyed virtually all wooden buildings associated with the homestead era and sites were largely reduced to rubble. The V-site, which was among the last vestiges of the Manhattan Project at Los Alamos and the site where work was conducted on the Trinity device, was

partially destroyed. Building TA-16-516, the Trinity Assembly Building, survived the fire. The leveling of a staging area in TA-49 during the fire destroyed one and damaged two other cultural resource sites. Also, two historic structures at TA-2 were adversely impacted by postfire activities (DOE 2000h).

At TA-18 early U.S. Territorial/Statehood period sites include a mule train trail of undetermined National Register of Historic Places eligibility that was used to haul hay from the Valles Caldera to the Ashley Pond cabin. The Ashley Pond cabin is listed on the New Mexico State Register of Historic Places. TA-18 contains 50 buildings and structures dating to WWII through the Early Cold War periods. A historic building eligibility assessment of these buildings is currently underway. Extensive erosion and storm-water control efforts initiated after the Cerro Grande Fire will have beneficial effects on the historic Ashley Pond cabin. This structure has been surrounded by concrete barriers and sandbags to prevent damage from debris carried by storm-water runoff. Construction of a flood retention structure upstream will also provide the Ashley Pond cabin additional protection from flooding (DOE 2000h).

Historic resources at TA-55 include the early U.S. Territorial/Statehood period homestead site that is not eligible for the National Register of Historic Places. Also present is a National Register of Historic Places-eligible early U.S. Territorial/Statehood period structure.

4.2.8.3 Native American Resources

Consultations to identify traditional cultural properties were conducted with 19 Native American tribes in connection with the preparation of the *LANL SWEIS*. Two Hispanic communities were also contacted. These consultations identified 15 ceremonial and archaeological sites, 14 natural features, 10 ethnobotanical sites, 7 artisan material sites, and 8 subsistence features. In addition to physical cultural entities, concern has been expressed that "spiritual," "unseen," "undocumentable," or "beingness" aspects can be present at LANL that are an important part of Native American culture and may be adversely impacted by LANL's presence and operation. Additional consultations regarding traditional cultural properties are ongoing for LANL and other nearby DOE administered properties.

4.2.8.4 Paleontological Resources

No paleontological sites are reported to occur within LANL boundaries, and the near-surface stratigraphy is not conducive to preserving plant and animal remains. These near-surface materials are volcanic ash and pumice that were extremely hot when deposited.

4.2.9 Socioeconomics

Statistics for population, housing, community services, and local transportation are presented for the region of influence, a three-county area in New Mexico **(Figure 4–8)** in which 89.7 percent of all LANL employees reside (see **Table 4–8**).

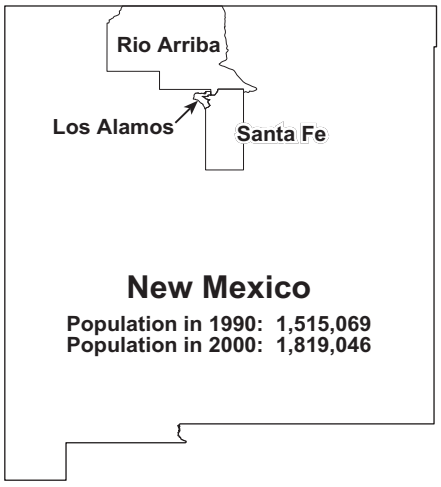


Figure 4–8 Counties in the LANL Region of Influence

4.2.9.1 Regional Economic Characteristics

Between 1990 and 1999, the civilian labor force in the Tri-County area increased 14.4 percent to the 1999 level of 92,189. In 1999, the annual unemployment average in the region of influence was 3.7 percent, which was less than the annual unemployment average of 5.6 percent for New Mexico (DOL 2000).

In 1997, government agencies and enterprises represented the largest sector of employment in the Tri-County area (35.6 percent). This was followed by service activities (29.5 percent) and retail (20.7 percent). The totals for these employment sectors in New Mexico were 25.1 percent, 27.5 percent, and 23.7 percent, respectively (NMDL 1998).

Table 4–8 Distribution of Employees by Place of Residence in the LANL Region of Influence in 1996

County	*Number of Employees* [a]	*Total Site Employment (percent)*
Los Alamos	5,381	50.8
Rio Arriba	2,149	20.3
Sante Fe	1,967	18.6
Region of influence total	9,497	89.7

[a] Data not available for nontechnical contractors or consultants.
Source: DOE 1999b.

4.2.9.2 Demographic Characteristics

The 2000 demographic profile of the region of influence population and income information is included in **Table 4–9**. Persons self-designated as minority individuals comprise 57.9 percent of the total population. This minority population is composed largely of Hispanic or Latino and American Indian residents. The Pueblos of San Ildefonso, Santa Clara, San Juan, Nambe, Pojoaque, Tesques, and part of the Jicarilla Apache Indian Reservation are included in the region of influence.

Income information for the LANL region of influence is included in **Table 4–10**. There are significant differences in the income levels among the three counties, especially between Rio Arriba County, at the low end, and Los Alamos County, at the upper end. The median household income in Los Alamos County is over double that of the New Mexico state average while the median household income of Rio Arriba County is below the state average. In 1997, only 2.7 percent of the population in Los Alamos was below the official poverty level while in Rio Arriba County, 22.5 percent of the population was below the poverty level.

Table 4–9 Demographic Profile of the Population in the LANL Region of Influence

	Los Alamos	*Rio Arriba*	*Sante Fe*	*Region of Influence*
Population				
2000 population	18,343	41,190	129,292	188,825
1990 population	18,115	34,365	98,928	151,408
Percent change from 1990 to 2000	1.3	19.9	30.7	24.7
Race (2000) (percent of total population)				
White	90.3	56.6	73.5	71.5
Black or African American	0.4	0.3	0.6	0.5
American Indian and Alaska Native	0.6	13.9	3.1	5.2
Asian	3.8	0.1	0.9	1.0
Native Hawaiian & Other Pacific Islander	0.0	0.1	0.1	0.1
Some other race	2.7	25.6	17.7	18.0
Two or more races	2.3	3.3	4.1	3.7
Percent minority	17.9	86.4	54.5	57.9
Ethnicity (2000)				
Hispanic or Latino	2,155	30,025	63,405	95,585
Percent of total population	11.7	72.9	49.0	50.6

Source: DOC 2001.

Table 4–10 Income Information for the LANL Region of Influence

	Los Alamos	*Rio Arriba*	*Sante Fe*	*New Mexico*
Median household income 1997 ($)	74,253	25,036	37,882	30,836
Percent of persons below poverty line (1997)	2.7	22.5	11.9	19.3

Source: DOC 2000.

4.2.9.3 Housing and Community Services

Table 4–11 lists the total number of occupied housing units and vacancy rates in the region of influence. In 1990, the Tri-County area contained 63,386 housing units, of which 56,514 were occupied. The median value of owner-occupied units was $125,100 in Los Alamos County, which is higher than the other two counties and over twice the median value of units in Rio Arriba County. The vacancy rate was lowest in Los Alamos County (4.7 percent) and highest in Rio Arriba County (20.2 percent). During the Cerro Grande Fire, approximately 230 housing units were destroyed or damaged in northern portions of Los Alamos County (DOE 2000h). As a result, vacancy rates have decreased.

Community services include public education and healthcare (i.e., hospitals, hospital beds, and doctors). In 1998, student enrollment totaled 26,290 in the region of influence and the average student-to-teacher ratio was 17:1 (Department of Education 2000). In 1998, three hospitals served the Tri-County area with a hospital bed-to-population ratio of 1.9 hospital beds per 1,000 persons. The average region of influence's physician-to-population ratio was 2.7 physicians per 1,000 persons (Gaquin and DeBrandt 2000).

Table 4–11 Housing and Community Services in the LANL Region of Influence

	Los Alamos	*Rio Arriba*	*Sante Fe*	*Region of Influence*
Housing (1990) [a]				
Total units	7,565	14,357	41,464	63,386
Occupied housing units	7,213	11,461	37,840	56,514
Vacant units	352	2,896	3,624	6,872
Vacancy rate (percent)	4.7	20.2	8.7	10.8
Median value ($)	125,100	57,900	103,300	Not available
Public Education (1998) [b]				
Total enrollment	3,674	6,917	15,699	26,290
Student-to-teacher ratio	14.8:1	18:1	17.2:1	17:1
Community Healthcare (1998) [c]				
Hospitals	1	1	1	3
Hospital beds per 1,000 persons	2.9	2.1	1.7	1.9
Physicians per 1,000 persons	2.6	0.9	3.3	2.7

[a] DOE 1999b.
[b] Department of Education 2000.
[c] Gaquin and DeBrandt 2000.

4.2.9.4 Local Transportation

Motor vehicles are the primary means of transportation to LANL. Regional transportation route(s) connecting LANL to Albuquerque and Santa Fe are I–25 to U.S. 84/285 to NM 502; to Española are NM 30 to NM 502; and to Jemez Springs and western communities is NM 4. Hazardous and radioactive material shipments leave or enter LANL from East Jemez Road to NM 4 to NM 502 (see Figure 4–1). Only two major roads, NM 502 and NM 4, access Los Alamos County. Los Alamos County traffic volume on these two segments of highway is primarily associated with LANL activities.

A public bus service located in Los Alamos operates within Los Alamos County. The Los Alamos bus system consists of seven buses that operate five days a week. The nearest commercial bus terminal is located in Santa Fe. The nearest commercial rail connection is at Lamy, New Mexico, 83 kilometers (52 miles) southeast of LANL. LANL does not currently use rail for commercial shipments. The primary commercial international airport in New Mexico is located in Albuquerque. The small Los Alamos County Airport is owned by the Federal Government, and the operations and maintenance are performed by the County of Los Alamos. The airport is located parallel to East Road at the southern edge of the Los Alamos community. Until January 1996, the airport provided regular passenger and cargo service through specialized contract carriers such as Ross Aviation, which were under contract with DOE to provide passenger and cargo air service to Los Alamos County and LANL. DOE continues to negotiate with various companies to provide for service to the Los Alamos Airport.

4.2.10 Environmental Justice

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. As discussed in Appendix E, minority persons are those who identify themselves as Hispanic or Latino, Asian, Black or African American, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or multiracial. Persons whose income is below the Federal poverty threshold are designated as low-income.

There are three candidate locations at LANL for location of missions currently performed at TA-18. These are TA-18,TA-39, and TA-55. **Figure 4–9** shows candidate locations at LANL and regions of potential radiological impact. As shown in the figure, areas potentially at radiological risk from the current missions performed at TA-18 include the City of Santa Fe and Indian Reservations in North Central New Mexico. Eight counties are included or partially included in the potentially affected area (See **Figure 4–10**): Bernallilo, Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos. **Table 4–12** provides the racial and Hispanic composition for these counties using data obtained from the decennial census conducted in 2000. In the year 2000, a majority of these county residents designated themselves as members of a minority. Hispanics and American Indians/Alaska Natives comprised over 90 percent of the minority population. As a percentage of the total resident population in 2000, New Mexico had the largest percentage minority population (55 percent) among the contiguous states and the second largest percentage minority population among all of the states (only Hawaii had a larger percentage minority population (77 percent)).

Figure 4–11 compares the growth in the minority populations in the potentially affected counties between 1990 and 2000. As discussed in Section E.5.1 of Appendix E, data concerning race and Hispanic origin from the 2000 Census cannot be directly compared with that for the 1990 Census because the racial categories used in the two enumerations were different. Bearing this change in mind, the minority population in potentially affected counties increased from approximately 49 percent to 54 percent in the decade from 1990 to 2000. Hispanics and American Indians/Alaska Natives accounted for over 80 percent of the increase in minority population during the decade. For comparison, minorities composed approximately one-quarter of the total population of the United States in 1990 and nearly one-third of the total population in 2000.

The percentage of low-income population at risk in potentially affected counties in 1990 was approximately 13 percent. In 1990, nearly 13 percent of the total population of the continental United States reported incomes less than the poverty threshold. In terms of percentages, minority populations at risk are relatively large in comparison with the national percentage, while the percentage low-income population at risk is commensurate with the corresponding national percentage. Complete census data with block group resolution for minority and low-income populations obtained from the decennial census of 2000 are scheduled for publication in 2002.

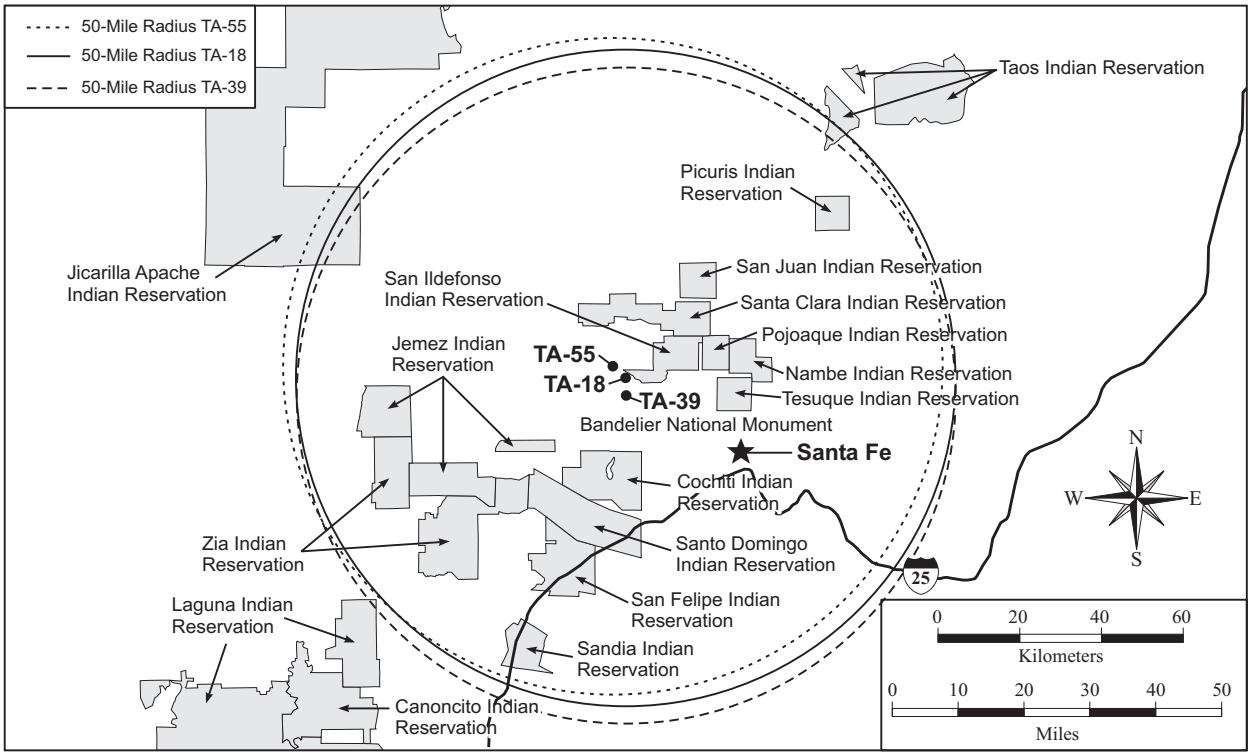


Figure 4–9 Candidate Locations and Indian Reservations Surrounding LANL

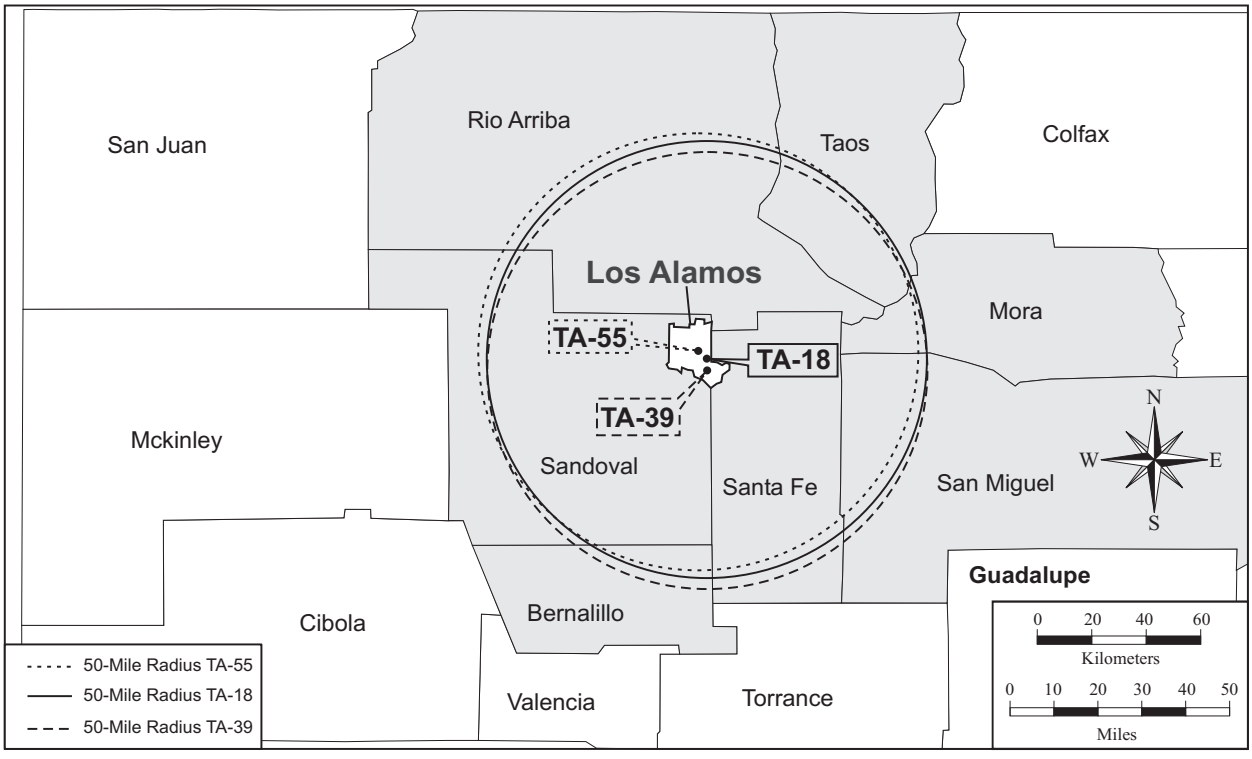


Figure 4–10 Potentially Affected Counties Surrounding LANL

Table 4–12 Populations in Potentially Affected Counties Surrounding LANL in 2000

Population Group	*Population*	*Percentage of Total*
Minority	488,850	54.3
Hispanic	400,673	44.5
Black/African American	16,204	1.8
American Indian/Alaska Native	44,430	4.9
Asian	13,195	1.5
Native Hawaiian/Pacific Islander	607	0.1
Two or More Races	13,741	1.5
Some Other Race	1,498	0.2
White	410,348	45.6
Total	900,696	100.0

Source: DOC 2001.

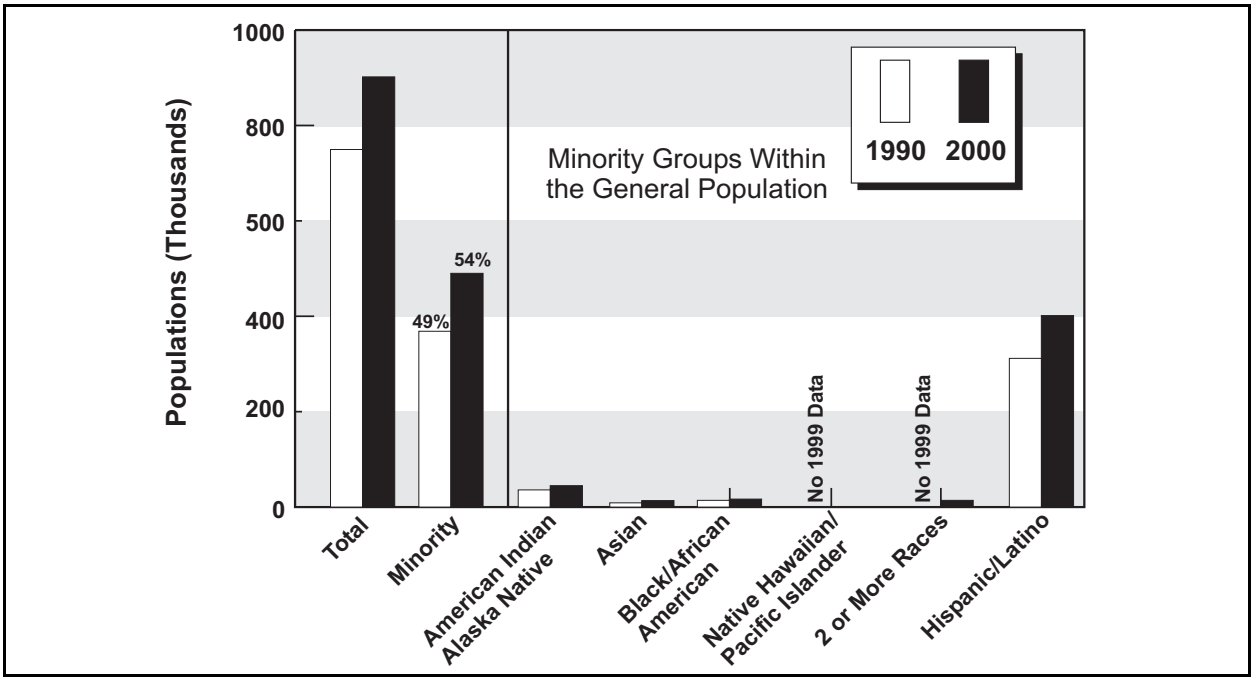


Figure 4–11 Comparison of Populations in Potentially Affected Counties Surrounding LANL in 1990 and 2000

4.2.11 Existing Human Health Risk

Public and occupational health and safety issues include the determination of potentially adverse effects on human health that result from acute and chronic exposure to ionizing radiation and hazardous chemicals.

4.2.11.1 Radiation Exposure and Risk

Major sources and levels of background radiation exposure to individuals in the vicinity of LANL are shown in **Table 4–13**. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population, in terms of person-rem, changes as the population size changes. Background radiation doses are unrelated to LANL operations.

Table 4–13 Sources of Radiation Exposure to Individuals in the LANL Vicinity Unrelated to LANL Operations

Source	*Effective Dose Equivalent (millirem per year)*
Natural Background Radiation	
Total external (cosmic and terrestrial) [a]	120
Internal terrestrial and global cosmogenic [b]	40
Radon in homes (inhaled)	200 [b, c]
Other Background Radiation [b]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	less than 1
Air travel	1
Consumer and industrial products	10
Total	425

[a] LANL 2000f.
[b] NCRP 1987.
[c] An average for the United States.

Releases of radionuclides to the environment from LANL operations provide another source of radiation exposure to individuals in the vicinity of LANL. Types and quantities of radionuclides released from LANL operations in 1999 are listed in *Environmental Surveillance at Los Alamos During 1999* (LANL 2000f). The releases are summarized in Sections 4.2.3.2 and 4.2.6.1 of this EIS. The doses to the public resulting from these releases are presented in **Table 4–14**. These doses fall within the radiological limits given in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and are much lower than those from background radiation.

Table 4–14 Radiation Doses to the Public from Normal LANL Operations in 1999 (total effective dose equivalent)

	Atmospheric Releases		*Liquid Releases*		*Total*	
Members of the Public	*Standard* [a]	*Actual*	*Standard* [a]	*Actual*	*Standard* [a]	*Actual*
Maximally exposed offsite individual (millirem)	10	0.40	4	0.25	100	0.65
Population within 80 kilometers (50 miles) (person-rem) [b]	None	0.30	None	~0	100	0.30
Average individual within 80 kilometers (50 miles) (millirem) [c]	None	0.0011	None	~0	None	0.0011

[a] The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10-millirem-per-year limit from airborne emissions is required by the Clean Air Act (40 CFR 61) and the 4-millirem-per-year limit is required by the Safe Drinking Water Act (40 CFR 141). For this EIS, the 4-millirem-per-year value is conservatively assumed to be the limit for the sum of doses from all liquid pathways. The total dose of 100 millirem per year is the limit from all pathways combined. The 100-person-rem value for the population is given in proposed 10 CFR 834, *Radiation Protection of the Public and the Environment: Proposed Rule,* as published in 58 FR 16268. If the potential total dose exceeds the 100-person-rem value, the contractor operating the facility would be required to notify DOE.
[b] About 264,000 based on county population estimates for 1999.
[c] Obtained by dividing the population dose by the number of people living within 80 kilometers (50 miles) of the site.
Note: About 80 percent of the dose to the maximally exposed onsite individual was attributable to TA-18 operations. The fractional dose contribution to offsite receptors from TA-18 operations is very small.
Source: LANL 2000f.

Using a risk estimator of one latent cancer death per 2,000 person-rem to the public (see Appendix B), the fatal cancer risk to the maximally exposed offsite member of the public due to radiological releases from LANL operations is estimated to be 3.3×10^{-7}. The estimated probability of this maximally exposed person

dying of cancer at some point in the future from radiation exposure associated with one year of LANL operations is less than one in one million (it takes several to many years from the time of radiation exposure for a cancer to manifest itself).

According to the same risk estimator, 1.5×10^{-4} excess fatal cancers are projected in the population living within 80 kilometers (50 miles) of LANL from normal LANL operations. To place this number in perspective, it may be compared with the number of fatal cancers expected in the same population from all causes. The mortality rate associated with cancer for the entire U.S. population is 0.2 percent per year. Based on this mortality rate, the number of fatal cancers expected during 1999 from all causes in the population of 264,000 living within 80 kilometers (50 miles) of LANL was 528. This expected number of fatal cancers is much higher than the 1.5×10^{-4} fatal cancers estimated from LANL operations in 1999.

Members of the public passing by the TA-18 facility along Pajarito Road could receive an external radiation dose from critical assembly operations at TA-18. Based on radiation doses that have been measured along Pajarito Road, the road is closed to the public for any operation that would result in more than 4.75 millirem in any hour along the road. As a result, the maximum dose that a member of the public would receive from a single operation at TA-18 would be 4.75 millirem (LANL 2001a).

LANL workers receive the same dose as the general public from background radiation, but they also receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker and the cumulative dose to all workers at LANL from operations in 1998 are presented in **Table 4–15**. These doses fall within the radiological regulatory limits of 10 CFR 835. According to a risk estimator of one latent fatal cancer per 2,500 person-rem among workers (see Appendix B), the number of projected fatal cancers among LANL workers from normal operations in 1998 is 0.065. The risk estimator for workers is lower than the estimator for the public because of the absence from the workforce of the more radiosensitive infant and child age groups.

Table 4–15 Radiation Doses to Workers from Normal LANL Operations in 1998 (total effective dose equivalent)

Occupational Personnel	*Onsite Releases and Direct Radiation*	
	Standard [a]	***Actual***
Average radiation worker (millirem)	None [b]	85
Total workers [c] (person-rem)	None	162

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 CFR 835). However, DOE's goal is to maintain radiological exposure as low as is reasonably achievable. Therefore, DOE has recommended an administrative control level of 500 millirem per year (DOE 1999e); the site must make reasonable attempts to maintain individual worker doses below this level.

[b] No standard is specified for an average radiation worker; however, the maximum dose that this worker may receive is limited to that given in footnote [a].

[c] There were 1,916 workers with measurable doses in 1998.

Source: DOE 1998c.

External radiation doses have been measured in areas of TA-18 and TA-55 that may contain radiological sources for comparison with offsite natural background radiation levels. Measurements taken in 1999 showed average doses within TA-18 and TA-55 of 189 millirem and 157 millirem, respectively, compared to an average offsite dose of 126 millirem (LANL 2000f).

In 1999, the average concentration in air of plutonium-239, gross alpha, and gross beta radiation on the LANL site were measured to be 1.5×10^{-18} curies per cubic meter, 9.4×10^{-16} curies per cubic meter, and 1.3×10^{-14} curies per cubic meter, respectively. The value of plutonium-239 does not include a relatively high "hot spot" in Technical Area 54. The concentration of plutonium-239 was about twice that measured at offsite regional locations; the concentrations of gross alpha and beta radiation were about the same as

measured regionally (LANL 2000f). No specific measurements were reported for Technical Areas 18 or 55, but the concentrations would be expected to be similar to the average site values.

4.2.11.2 Chemical Environment

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (e.g., soil through direct contact or via the food pathway).

Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at LANL via inhalation of air containing hazardous chemicals released to the atmosphere by LANL operations. Risks to public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

Baseline air emission concentrations for air pollutants and their applicable standards are presented in Section 4.2.3.1. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are compared with applicable guidelines and regulations.

Chemical exposure pathways to LANL workers during normal operations may include inhaling the workplace atmosphere, drinking LANL potable water, and possible other contact with hazardous materials associated with work assignments. Workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. LANL workers are also protected by adherence to the Occupational Safety and Health Administration (OSHA) and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals used in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at LANL are substantially better than required by standards.

4.2.11.3 Health Effects Studies

Numerous epidemiological studies have been conducted in the LANL area. These studies have been summarized in the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (SSM PEIS)* (DOE 1996f). One study conducted by the New Mexico Department of Health reported elevations in brain cancer incidence during the mid to late 1980s, compared to state and national reference populations, but random fluctuation could not be ruled out. Breast cancer incidence rates in Los Alamos from 1970 to 1990 remained level, but higher than New Mexico rates. Reproductive and demographic factors known to increase the risk of breast cancer have been prevalent in the county. Ovarian cancer incidence in the county from 1986 to 1990 was approximately twofold greater than that observed in a New Mexico State reference population. In the mid to late-1980s, a twofold excess risk of melanoma was observed in Los Alamos County compared with a New Mexico State reference population. A more recent study observed a fourfold increase in thyroid cancer incidence during the late 1980s and early 1990s compared with the state as a whole, but the rate began to decline in 1994 and 1995. No statistically significant excess cancers were reported for male workers exposed to plutonium. However, statistically significant excesses in kidney cancer and lymphomatic leukemia were observed in male workers exposed

to external radiation. For more detailed descriptions of studies reviewed and the findings, refer to Appendix Section D.1.2 of the *LANL SWEIS* and to Appendix Section E.4.6 of the *SSM PEIS* (DOE 1996f).

4.2.11.4 Accident History

Although LANL experienced a number of criticality accidents in the period of 1945 to the early 1980s, a review of more recent LANL annual environmental and accident reports indicates that there have been no accidents since that time that have resulted in significant adverse impacts to workers, the public, or the environment (DOE 1996g). During the review period, from 1986 to 1990, site operations were much higher than in previous years and also higher than what is anticipated for the future (DOE 1996g).

On May 4, 2000, the National Park Service at Bandelier National Monument set a prescribed fire that subsequently burned out of control. This Cerro Grande Fire damaged or destroyed 112 LANL structures and about 230 residential structures in the Los Alamos town site. By the time it was contained, it had burned 3,061 hectares (7,650 acres) within the boundaries of LANL. LANL is conducting an extensive environmental monitoring and sampling program to evaluate the effects of that fire at the laboratory and especially to evaluate if public and worker health and the environment were adversely impacted by the fire on laboratory land. The program will identify changes from prefire baseline conditions that will aid in evaluating potential future impacts, especially those from any contaminants that may have been transported off site (LANL 2000f).

4.2.11.5 Emergency Preparedness

Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response to most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program includes emergency planning, training, preparedness, and response. The emergency management program was activated on May 5, 2000 to coordinate emergency management operations during the Cerro Grande Fire.

DOE maintains equipment and procedures to respond to situations where human health or the environment is threatened. These include specialized training and equipment for the local fire department, local hospitals, state public safety organizations, and other government entities that may participate in response actions, as well as specialized assistance teams (DOE Order 151.1, *Comprehensive Emergency Management System*). These programs also provide for notification of local governments whose constituencies may be threatened. Broad ranges of exercises are run to ensure the systems are working properly, from facility-specific exercises to regional responses. In addition, DOE has specified actions to be taken at all DOE sites to implement lessons learned from the emergency responses to an accidental explosion at Hanford in May 1997.

4.2.12 Waste Management

Waste management includes minimization, characterization, treatment, storage, transportation, and disposal of waste generated from ongoing DOE activities. The waste is managed using appropriate treatment, storage, and disposal technologies, and in compliance with all applicable Federal and state statutes and DOE orders.

4.2.12.1 Waste Inventories and Activities

LANL manages the following types of waste: transuranic, mixed transuranic, low-level radioactive, mixed low-level radioactive, hazardous, and nonhazardous. Because there is no transuranic or mixed transuranic waste associated with TA-18 operations, these waste types are not discussed in this EIS. Waste generation

rates and the inventory of stored waste from activities at LANL are provided in **Table 4–16**. Selected waste management facilities at LANL are summarized in **Table 4–17**.

Table 4–16 Selected Waste Generation Rates and Inventories at LANL

Waste Type	*Generation Rate (cubic meters per year)*	*Inventory (cubic meters)*
Low-level radioactive	2,840 [a]	Not available
Mixed low-level radioactive	98 [a]	759 [a]
Hazardous (in kilograms)	860,600 [a,b]	Not applicable [c]
Nonhazardous		
Liquid	692,857 [d]	Not applicable [c]
Solid	5,453 [d]	Not applicable [c]

[a] DOE 1999b.
[b] This waste type also includes biomedical waste.
[c] Generally, hazardous and nonhazardous waste are not held in long-term storage.
[d] DOE 1999i.
Note: The generation rates are attributed to facility operations and do not include the waste generated from environmental restoration actions.

Table 4–17 Selected Waste Management Facilities at LANL

Facility Name/Description	*Capacity*	*Status*	*Applicable Waste Type*			
			Low-Level Radioactive Waste	*Mixed Low-Level Radioactive Waste*	*Hazardous*	*Nonhazardous*
Treatment Facility (cubic meters per year)						
Low-level radioactive waste compaction	76	Online	X			
Sanitary wastewater treatment	1,060,063	Online				X
Storage Facility (cubic meters)						
Low-level radioactive waste storage	663	Online	X			
Mixed low-level radioactive waste storage	583	Online		X		
Hazardous waste storage	1,864	Online			X	
Disposal Facility						
TA-54 Area G low-level radioactive waste disposal (cubic meters)	252,500[a]	Online	X			
Sanitary tile fields (cubic meters per year)	567,750	Online				X

[a] Current inventory of 250,000 cubic meters. Capacity will be expanded as part of implementation of the *LANL SWEIS* Record of Decision.
Source: DOE 1999i.

Although not listed on the National Priorities List, LANL adheres to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines for environmental restoration projects that involve certain hazardous substances not covered by the Resource Conservation and Recovery Act (RCRA). LANL's environmental restoration program originally consisted of approximately 2,100 potential release sites (DOE 1999i). At the end of 1999, there remained 1,206 potential release sites requiring investigation or remediation and 118 buildings awaiting decontamination and decommissioning. Potential release sites at TA-18 have been investigated and characterized. Most of the potential release sites have been recommended for no further action, following site characterization. Several potential release sites at TA-18 have undergone either interim or final remediation to remove contaminants and decrease the potential for

future releases and migration off site. Based on a review by LANL's Environmental Restoration Project, the boundary of Potential Release Site 48-001 overlaps a small area in the corner of the proposed relocation site at TA-55. This area of overlap involves possible surface soil contamination from TA-48 stack emissions. Further investigation and any necessary remediation of this site will be completed under LANL's environmental restoration program (LANL 2001b) and in accordance with LANL's Hazardous Waste Facility Permit. More information on regulatory requirements for waste disposal is provided in Chapter 6.

4.2.12.2 Low-Level Radioactive Waste

Solid low-level radioactive waste generated by LANL's operating divisions is characterized and packaged for disposal at the onsite low-level radioactive waste disposal facility at TA-54, Area G. Low-level radioactive waste minimization strategies are intended to reduce the environmental impact associated with low-level radioactive waste operations and waste disposal by reducing the amount of low-level radioactive waste generated and/or minimizing the volume of low-level radioactive waste that will require storage or disposal onsite (LANL 2000a).

A 1998 analysis of the low-level radioactive waste landfill at TA-54, Area G, indicated that at previously planned rates of disposal, the disposal capacity would be exhausted in a few years. Reduction in low-level radioactive waste generation has extended this time to approximately five years; however, potentially large volumes of waste from planned construction upgrades could rapidly fill the remaining capacity (LANL 2000a).

As part of the implementation of the Record of Decision in the *LANL SWEIS*, DOE will continue onsite disposal of LANL-generated low-level radioactive waste using the existing footprint at the Area G low-level waste disposal area and will expand disposal capacity into Zones 4 and 6 at Area G. This expansion would cover up to 29 hectares (72 acres). Additional sites for low-level radioactive waste disposal at Area G would provide onsite disposal for an additional 50 to 100 years (64 FR 50797, LANL 2000a).

Liquid low-level radioactive waste is transferred through a system of pipes and by tanker trucks to the Radioactive Liquid Waste Treatment Facility at TA-50, Building 1. The radioactive components are removed and disposed of as solid low-level radioactive waste at TA-54, Area G. The remaining liquid is discharged to a permitted outfall (LANL 2000a).

4.2.12.3 Mixed Low-Level Radioactive Waste

There are seven major mixed low-level radioactive waste streams at LANL: circuit boards, gloveboxes, lead parts, research and development chemicals, personal protective equipment, fluorescent tubes, and waste generated from spills and spill cleanup. Typically, mixed low-level radioactive waste is transferred to a satellite storage area once generated. Whenever possible, mixed low-level materials are surveyed to confirm the radiological contamination levels, and if decontamination will eliminate either the radiological or the hazardous component, materials are decontaminated and removed from the mixed low-level radioactive waste category (LANL 2000a).

Proper waste management and Department of Transportation documentation are provided for solid waste operations at TA-54, Area G or Area L, to process remaining mixed low-level radioactive waste for storage, bulking, and transportation. From TA-54, mixed low-level radioactive waste is sent to commercial and DOE treatment and disposal facilities. The waste is treated/disposed of by various processes (e.g., segregation of hazardous components, macroencapsulation, or incineration) (LANL 2000a).

In October 1995, the State of New Mexico issued a Federal Facility Compliance Order to both DOE and LANL requiring compliance with the site treatment plan. That plan documents the development of treatment capacities and technologies or use of offsite facilities for treating mixed waste generated at LANL that is stored beyond the one-year time frame (LANL 2000f).

4.2.12.4 Hazardous Waste

Most LANL activities generate some amount of hazardous waste. Hazardous waste commonly generated at LANL includes many types of laboratory research chemicals, solvents, acids, bases, carcinogens, compressed gases, metals, and other solid waste contaminated with hazardous waste. This may include equipment, containers, structures, and other items intended for disposal and contaminated with hazardous waste (e.g., compressed gas cylinders). After the hazardous waste is collected, it is sorted and segregated. Some materials are reused within LANL, and others are decontaminated for reuse. Those materials that cannot be decontaminated or recycled are packaged and shipped to offsite RCRA-permitted treatment and disposal facilities (LANL 2000a).

4.2.12.5 Nonhazardous Waste

Both LANL and Los Alamos County use the same landfill located within LANL boundaries. The landfill is operated under a special permit by Los Alamos County. The Los Alamos County Landfill received about 20 million kilograms (22,013 tons) of solid waste from all sources during the period of July 1995 through June 1996, with LANL contributing about 22 percent of the solid waste. Since the Cerro Grande Fire, the generation of wastes from community and LANL cleanup activities have increased several fold. The Los Alamos County landfill is scheduled for closure on June 30, 2004. A replacement facility, which would be located offsite, would then be used by LANL for nonhazardous waste disposal. It is currently anticipated that the replacement facility would be located within 160 kilometers (100 miles) of LANL. Both LANL and Los Alamos County would need to transport their wastes to the new facility.

Sanitary liquid waste is delivered by dedicated pipelines to the Sanitary Wastewater Systems Consolidation Plant at TA-46. The plant has a design capacity of 2.27 million liters (600,000 gallons) per day, and in 2000 processed a maximum of about 950,000 liters (250,000 gallons) per day. Some septic tank pumpings are delivered periodically to the plant for treatment via tanker truck. Sanitary waste is treated by an aerobic digestion process. After treatment, the liquid from this process is recycled to the TA-3 power plant for use in cooling towers or is discharged to Sandia Canyon adjacent to the power plant under an NPDES permit and groundwater discharge plan. Under normal operating conditions, the solids from this process are dried in beds at the Sanitary Wastewater Systems Consolidation Plant and are applied as fertilizer as authorized by the existing NPDES permit.

4.2.12.6 Waste Minimization

LANL's Environmental Stewardship Office manages LANL's pollution prevention program. This is accomplished by eliminating waste through source reduction or material substitution; by recycling potential waste materials that cannot be minimized or eliminated; and by treating all waste that is generated to reduce its volume, toxicity, or mobility prior to storage or disposal. The achievements and progress have been updated at least annually. Implementing pollution prevention projects reduced the total amount of waste generated at LANL in 1999 by approximately 2,459 cubic meters (3,216 cubic yards). Examples of pollution prevention projects completed in 1999 at LANL include reduction of low-level radioactive waste and mixed low-level radioactive waste by 116 cubic meters (152 cubic yards) by decontaminating waste metal and reduction of transuranic waste by 3 cubic meters (4 cubic yards) by using improved nondestructive assay

instrumentation, which enabled the measurement and characterization of waste as either transuranic or low-level radioactive waste (DOE 2000i).

4.2.12.7 Waste Management PEIS Records of Decision

The *Final Waste Management Programmatic Environmental Impact Statement for Managing, Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (*Waste Management PEIS*) Records of Decision affecting LANL are shown in **Table 4–18**. Decisions on the various waste types were announced in a series of Records of Decision that have been published on the *Waste Management PEIS* (DOE 1997a). The hazardous waste Record of Decision was published on August 5, 1998 (63 FR 41810), and the low-level radioactive and mixed low-level radioactive waste Record of Decision was published on February 18, 2000 (65 FR 10061). The hazardous waste Record of Decision states that most DOE sites will continue to use offsite facilities for the treatment and disposal of major portions of the nonwastewater hazardous waste, with the Oak Ridge Reservation and the Savannah River Site continuing to treat some of their own nonwastewater hazardous waste on site in existing facilities, where this is economically feasible. The low-level radioactive waste and mixed low-level radioactive waste Record of Decision states that, for the management of low-level radioactive waste, minimal treatment will be performed at all sites, and disposal will continue, to the extent practicable, on site at INEEL, LANL, the Oak Ridge Reservation, and the Savannah River Site. In addition, Hanford and NTS will be available to all DOE sites for low-level radioactive waste disposal. Mixed low-level radioactive waste will be treated at Hanford, INEEL, the Oak Ridge Reservation, and the Savannah River Site and disposed of at Hanford and NTS. More detailed information concerning DOE's decisions for the future configuration of waste management facilities at LANL is presented in the hazardous waste and the low-level radioactive and mixed low-level radioactive waste Records of Decision.

Table 4–18 Waste Management PEIS Records of Decision Affecting LANL

Waste Type	*Preferred Action*
Low-level radioactive	DOE has decided to treat LANL's low-level radioactive waste on site and continue onsite disposal. [a]
Mixed low-level radioactive	DOE has decided to regionalize treatment of mixed low-level radioactive waste at the Hanford Site, INEEL, the Oak Ridge Reservation, and the Savannah River Site. DOE has decided to ship LANL's mixed low-level radioactive waste to either the Hanford Site or NTS for disposal. [a]
Hazardous	DOE has decided to continue to use commercial facilities for treatment of most of LANL's nonwastewater hazardous waste. [b]

[a] From the Record of Decision for low-level radioactive and mixed low-level radioactive waste (65 FR 10061).
[b] From the Record of Decision for hazardous waste (63 FR 41810).
Source: 65 FR 10061, 63 FR 41810.

4.3 SANDIA NATIONAL LABORATORIES/NEW MEXICO

SNL/NM is located within KAFB, approximately 11 kilometers (7 miles) southeast of downtown Albuquerque, New Mexico (see **Figure 4–12**). Albuquerque is located in Bernalillo County, in north central New Mexico, and is the state's largest city, with a population of approximately 420,000. The Sandia Mountains rise steeply immediately north and east of the city, with the Manzanita Mountains extending to the southeast. The Rio Grande runs southward through Albuquerque and is the primary river traversing central New Mexico. Nearby communities include Rio Rancho and Corrales, each located about 25 kilometers (15.5 miles) to the northwest. The Pueblo of Sandia and town of Bernalillo are located 34 kilometers (21 miles) and 39 kilometers (24 miles), respectively, to the north. The Pueblo of Isleta and towns of Los Lunas and Belen are located 17 kilometers (10.5 miles), 28 kilometers (17.5 miles), and 45 kilometers (28 miles), respectively, to the southwest.

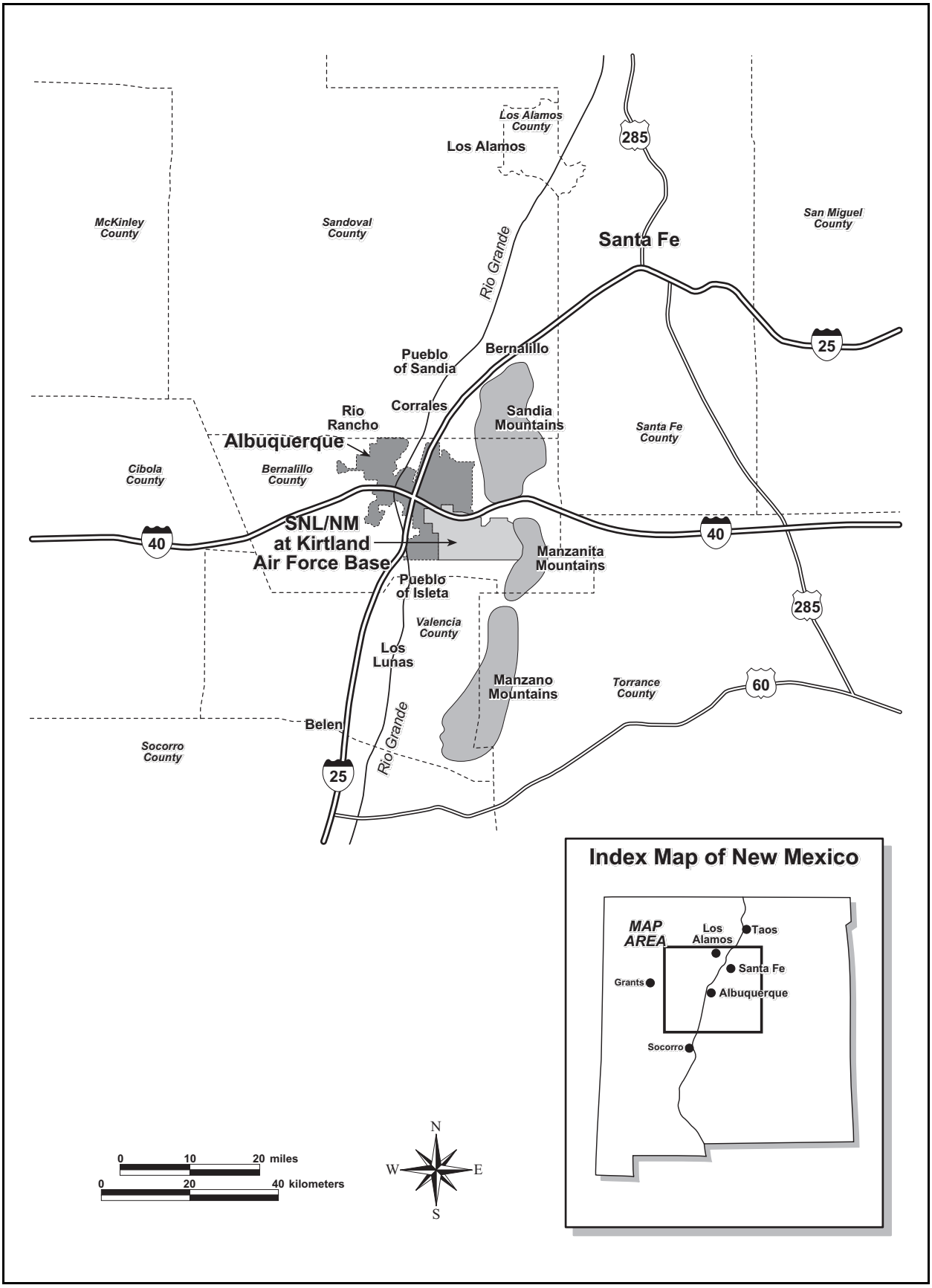


Figure 4–12 Location of SNL/NM

SNL/NM uses approximately 3,560 hectares (8,800 acres) of Federal land on KAFB which is administered by DOE's NNSA. There are approximately 670 buildings at SNL/NM, plus a number of structures associated with outdoor test areas. DOE missions at SNL/NM are conducted within five TAs, as well as several outdoor test areas. TAs comprise the basic geographic configuration of SNL/NM (see **Figure 4–13**). TA-I is the main administration and site support area and contains several laboratories. TA-II consists primarily of support service facilities along with the new Explosive Components Facility, several active and inactive waste management facilities, and vacated facilities replaced by the Explosive Components Facility. TA-III is devoted primarily to physical testing; TA-IV contains primarily accelerator operations; and TA-V contains primarily reactor facilities. The Coyote Test Field and the Withdrawn Area are used for outdoor testing (DOE 1999f). Unless otherwise referenced, the following descriptions of the affected environment at SNL/NM and TA-V are based all or in part on information provided in the *SNL/NM SWEIS* (DOE 1999f), which is incorporated by reference.

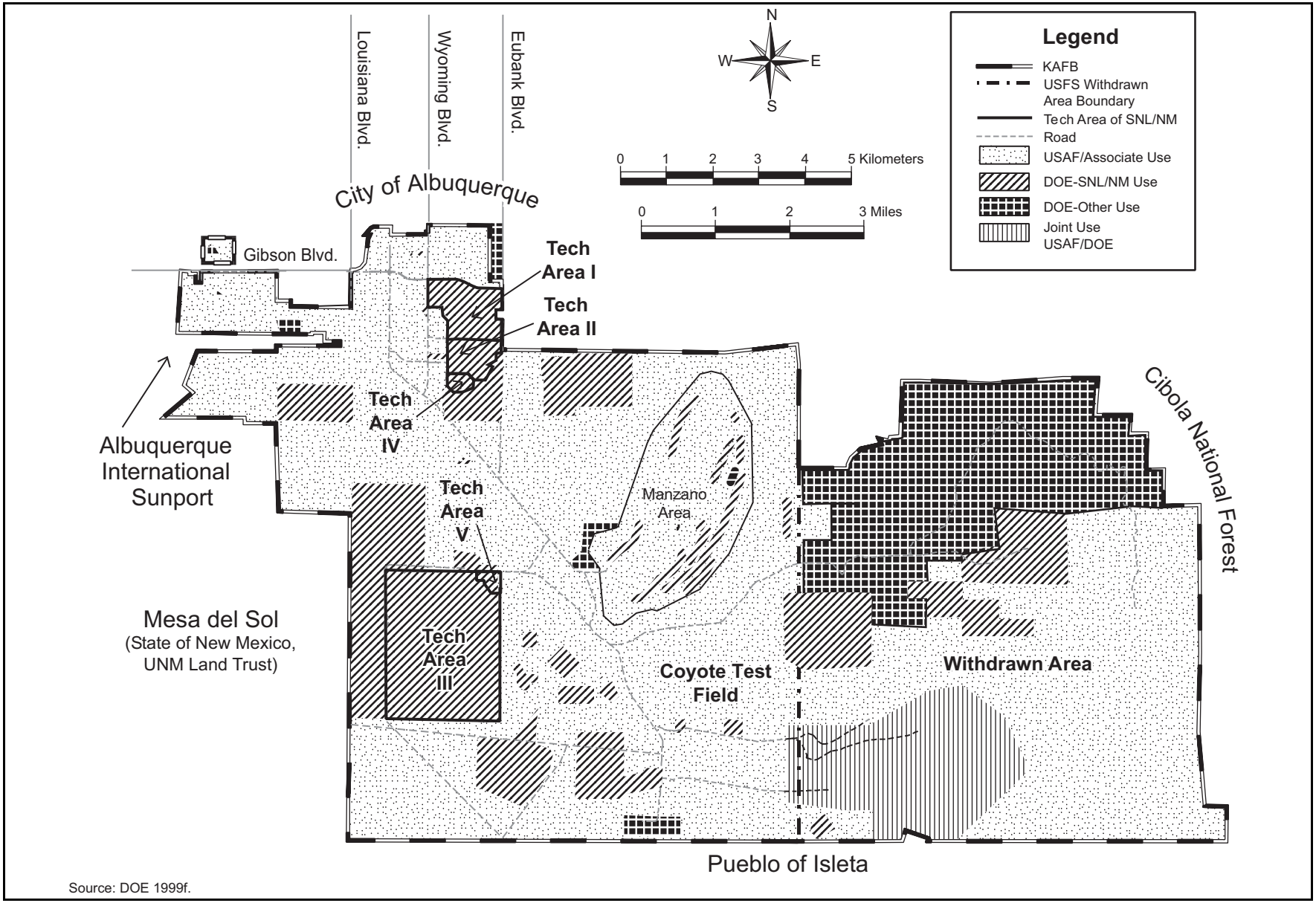
4.3.1 Land Resources

4.3.1.1 Land Use

KAFB is an Air Force Materiel Command Base located southeast of Albuquerque, New Mexico. KAFB shares facilities and infrastructure with several organizations, including DOE. It is comprised of 20,865 hectares (51,559 acres) of land, including portions of Cibola National Forest withdrawn in cooperation with the U.S. Forest Service. KAFB is geographically bounded by the Pueblo of Isleta to the south, the Albuquerque International Sunport and lands held in trust by the State of New Mexico to the west, and the city of Albuquerque to the north (see Figure 4–13). The eastern boundary lies within the Manzanita Mountains. Land owned by the Pueblo of Isleta is a wide expanse of open rangeland. Lands held in trust by the State of New Mexico include the Mesa del Sol area, which is a 5,260-hectare (13,000-acre) parcel of vacant land that has been annexed by the city of Albuquerque and will be developed in the future. The city of Albuquerque has the most influence on land use adjacent to the north-northwestern boundary of KAFB. The city has experienced steady growth in these areas characterized by single-family and multi-family residential dwellings, mixed/minor commercial establishments, and light industrial/wholesale operations. The northeast boundary of KAFB is surrounded almost entirely by Cibola National Forest.

Land ownership on KAFB is divided primarily among the U.S. Air Force (49 percent), the U.S. Forest Service (31 percent), DOE (6 percent), and the Bureau of Land Management (5 percent). The majority of acreage comprising the western half of KAFB is owned by the U.S. Air Force. DOE also owns land in this area, which is occupied almost entirely by SNL/NM facilities. Some land in the southwestern half of the base is owned by the Bureau of Land Management and has been withdrawn by the U.S. Air Force. The eastern portion of KAFB, commonly referred to as the Withdrawn Area, consists of more than 8,288 hectares (20,480 acres) of U.S. Forest Service land within the Cibola National Forest that has been withdrawn by the U.S. Air Force and DOE in separate actions.

The U.S. Air Force and DOE are the principal land users within the KAFB. Land use is established through coordination and planning agreements between these agencies. On matters involving the Withdrawn Area, the U.S. Forest Service is also involved. The U.S. Air Force operates on much of its own land, as well as on property within its portion of the Withdrawn Area. DOE owns only a small portion of the land it needs, and is required to conduct many of its activities under permit on land owned or withdrawn by the U.S. Air Force or within its section of the Withdrawn Area. DOE also leases land adjacent to KAFB to support SNL/NM activities. SNL/NM facilities and operations encompass the majority of DOE's land use requirements on KAFB. Other DOE-funded facilities located on KAFB include the Lovelace Respiratory Research Institute; the Nonproliferation and National Security Institute; the Transportation Safeguards Division; Federal



Source: DOE 1999f.

Figure 4–13 Land Use at KAFB

Manufacturing and Technology/New Mexico; Ross Aviation, Inc.; the Energy Training Center; and the DOE/Albuquerque Operations Office.

There is no single comprehensive land use plan for KAFB; however, existing land use designations and future planning scenarios are addressed in documents produced by the U.S. Air Force, the U.S. Forest Service, and SNL/NM. As discussed in the *SNL/NM SWEIS*, these documents include the *KAFB Comprehensive Plan*, the *Cibola National Forest Land and Resource Management Plan*, the *SNL Sites Comprehensive Plan*, and *SNL Sites Integrated Master Plan*.

The primary land use at SNL/NM fits into the industrial/research park category. This category coincides with the preliminary future use scenarios presented to the Citizens Advisory Board of the Future Use, Logistics, and Support Working Group. KAFB land used by the U.S. Air Force is also designated for industrial use, but includes a broader range of other uses such as residential, recreational, and medical activities that are associated with day-to-day base operations. Additionally, large areas of land within KAFB, particularly in the Withdrawn Area, do not support specific facilities or programs, but are used as safety zones in association with U.S. Air Force and DOE testing and training activities. The five SNL/NM TAs cover approximately 1,036 hectares (2,560 acres), or 87 percent of DOE-owned land. The land area covered by TAs-I through V is 142 hectares (350 acres), 85 hectares (210 acres), 765 hectares (1,890 acres), 34 hectares (85 acres), and 10 hectares (25 acres), respectively.

TA-V is located adjacent to the northeast corner of TA-III (see Figure 4–13). In addition to DOE-owned lands within the boundaries of TA-V, approximately 2.4 hectares (2 acres) are permitted to DOE by the U.S. Air Force to provide additional security. TA-V is a relatively small research area consisting of about 35 closely grouped structures with little open space (see Figure 3–7). Experimental and engineering nuclear reactors are located within the site. Approximately 159 personnel work in the area.

4.3.1.2 Visual Resources

The surrounding visual characteristics of SNL/NM consist of mostly flat, gently sloping grassland to the west and mountainous terrain to the east. Key landforms that dominate views in the general area include the Four Hills Formation, the Manzanita Mountains, and the Manzano Mountains further south. From areas of Albuquerque nearest KAFB, views to the east and southeast are limited by the Four Hills Formation and surrounding foothills of the Manzano area. Views to the south partially consist of KAFB facilities, the Albuquerque International Sunport, and open rangeland. In general, the terrain features associated with the western portion of KAFB are not particularly distinctive. The eastern half, however, exhibits greater visual variety due to its mountain and canyon topography. Most SNL/NM facilities are well within the KAFB boundary. Because of their location and the surrounding terrain characteristics, most facilities are not visible from roads and areas with public access. Distant views of TA-I are possible from eastbound Interstate 40, but they are brief and show limited detail. Views from Interstate 25 consist of background landscapes only.

Development is the most apparent modern alteration of the natural environment on KAFB affecting visual resources. Much of this activity is striking in nature and characterized by an urban setting with large buildings, extensive roadways, utility structures, parking lots, and other developed areas. The northwestern portion of KAFB, which includes SNL/NM TAs-I, -II and -IV, is the most populated and densely developed area that exemplifies these conditions. Although limited in size, TA-V is also heavily developed. TA-III has a more limited and scattered development pattern, but similarly exhibits a variety of man-made modifications that affect the visual environment. Developed areas of SNL/NM have a Bureau of Land Management Visual Resource Contrast Class IV rating (i.e., management activities dominate the view and are the major focus of viewer attention). SNL/NM has initiated Campus Design Guidelines in an effort to give more consideration to visual impacts. The Coyote Test Field and particularly the Withdrawn Area are more

sparsely developed. Undeveloped and sparsely developed lands within KAFB have a Visual Resource Contrast rating of Class II or III. Management activities within these classes may be seen but should not dominate the view.

TA-V, which, as noted above, contains 35 closely grouped structures within a relatively small area, has a Class IV Visual Resource Management Contrast rating.

4.3.2 Site Infrastructure

Site infrastructure characteristics for SNL/NM and KAFB are summarized in **Table 4–19**.

Table 4–19 SNL/NM and KAFB Sitewide Infrastructure Characteristics

Resource	*Site Usage* [a]	*Site Capacity* [a]
Transportation		
Roads (kilometers)	72 [b]	Not applicable
Railroads (kilometers)	0	Not applicable
Electricity		
Energy (megawatt-hours per year)	504,000	1,100,000
Peak load (megawatts)	69 [c]	125
Fuel		
Natural gas (cubic meters per year)	35,700,000	65,100,000
Liquid fuels	1,500,000	Not applicable
Coal (metric tons per year)	0	0
Water (liters per year)	4,400,000,000	7,600,000,000

[a] Site usage and capacity values are for all of KAFB, of which SNL/NM is a part, with the exception of liquid fuels usage which is available for SNL/NM only.
[b] Includes paved and unpaved roads.
[c] Peak load estimated from site-wide electrical energy capacity assuming peak load is 120 percent of average demand.
Sources: DOE 1999f.

4.3.2.1 Ground Transportation

The site maintains about 32 kilometers (20 miles) of paved roads and 40 kilometers (25 miles) of unpaved roads (see Table 4–19). There are also approximately 65 hectares (160 acres) of paved service and parking areas. Rail facilities are not available on KAFB. Local and linking transportation systems, including roadways, are detailed in Section 4.3.9.4.

4.3.2.2 Electricity

Electrical service to KAFB and SNL/NM is supplied by Public Service Company of New Mexico. The electrical transmission system is a high-voltage (46-kilovolt) overhead transmission system from the Public Service Company of New Mexico to the various substations within SNL/NM. SNL/NM maintains approximately 185 kilometers (115 miles) of electrical transmission/distribution lines and 26 master unit substations that distribute all its electrical power. The Public Service Company of New Mexico provides power to SNL/NM through the Eubank substation, located east of SNL/NM. A second source of power from the Public Service Company of New Mexico is currently under construction south of TA-IV. South of Tijeras Arroyo, KAFB owns and maintains the transmission lines that support SNL/NM facilities. The system has experienced outages to facilities in TAs-III, -IV, and -V and the Coyote Test Field. Improvements to the system are anticipated pending completion of an upgrade project.

The KAFB electrical capacity is about 1.1 million megawatt-hours per year (see Table 4–19). In 1996, SNL/NM used 197,000 megawatt-hours of electricity. The rest of KAFB used 307,000 megawatt-hours of electricity in 1996. Peak load usage at SNL/NM is 32 megawatts (DOE 1996f). It is estimated that KAFB and SNL/NM have a combined peak load demand of about 69 megawatts. Site-wide peak load capacity is 125 megawatts. Electric power usage at TA-V is estimated to be approximately 5,000 mega-watt-hours annually (SNL/NM 2001a).

4.3.2.3 Fuel

Natural gas supplied by the Public Service Company of New Mexico to SNL/NM and KAFB is the primary heating fuel used at the SNL/NM steam plant. The source of natural gas to KAFB and the SNL/NM central steam plant is a high-pressure line that enters KAFB near the intersection of Pennsylvania Avenue and Gibson Boulevard. SNL/NM also maintains 7.2 kilometers (4.5 miles) of gas line. Natural gas is also supplied to self-contained boilers at SNL/NM facilities in TAs-I, -II, and -IV, which are not on the steam distribution system. Laboratories also use natural gas in many of the buildings for heating and experiments. Diesel fuel is used as an emergency backup during natural gas pressure interruptions.

The KAFB natural gas delivery system has a capacity of about 65 million cubic meters (2.3 billion cubic feet) per year (Table 4–19). In 1996, SNL/NM used approximately 16.4 million cubic meters (580 million cubic feet) of natural gas. Other KAFB users accounted for about 19.3 million cubic meters (680 million cubic feet) of additional natural gas usage. SNL/NM use of propane was about 1.4 million liters (370,000 gallons) and is used in TAs-III and -V and in other remote locations. Diesel fuel use was approximately 57,000 liters (15,000 gallons) in 1996. Annual propane and fuel oil use by other KAFB users is not available. TA-V uses approximately 142,000 cubic meters (5 million cubic feet) of natural gas and about 189,000 liters (50,000 gallons) of propane annually (SNL/NM 2001a).

4.3.2.4 Water

KAFB owns and operates the water supply and distribution system, which includes piping, the main booster pump station, storage reservoirs, and wells. Water is supplied from wells located generally in the northwestern portion of KAFB that withdraw from the Santa Fe Group (see Section 4.3.6.2). Neither the existing water service from KAFB to SNL/NM, nor most major SNL/NM facilities are metered. The system has a capacity of approximately 7.6 billion liters (2 billion gallons) per year (Table 4–19). In 1996, SNL/NM used approximately 1.7 billion liters (440 million gallons) of water. Other KAFB users accounted for about 2.7 billion liters (710 million gallons) of additional water usage. TA-V uses about 6.1 million liters (1.6 million gallons) of water per year (SNL/NM 2001a).

4.3.3 Air Quality

The climate at SNL/NM and in the surrounding region is semiarid. The ambient temperatures in the region are characteristic of high-altitude, dry continental climates. Winter daytime temperatures average approximately 10 °C (50 °F), with nighttime temperatures often dropping into the low teens. Summer daytime temperatures generally do not exceed 32 °C (90 °F), except in July, when average maximum temperatures reach 34 °C (93 °F). The Albuquerque basin is characterized by low precipitation, averaging between 19 and 25 centimeters (7.5 and 10 inches) per year. Most of this precipitation falls from July through September and usually occurs from thunderstorm activities and the intrusion of warm, moist tropical air from the Pacific Ocean. The storms are accompanied by localized heavy wind gusts. Winter months are typically dry, with less than 5 centimeters (2 inches) of precipitation and limited snowfall. The average annual relative humidity is about 43 percent. New Mexico has one of the greatest frequencies of lightning in the United States. Tornadoes are uncommon in the Albuquerque basin.

Temperature, relative humidity, and precipitation do not vary dramatically across the region. Daily and seasonal wind patterns occur near the mountains and plateau. Daytime up-slope flows are usually coupled with downslope flows during the night. Strong springtime, easterly winds occur near canyons, and light north-south flows occur in the Rio Grande Valley. In general, areas closer to the mountains or canyons experience more frequent winds from an easterly direction at night. Daytime wind patterns are not as pronounced, but generally flow toward the mountains or along the Rio Grande Valley. The Rio Grande Valley experiences the most frequent calm conditions and the lowest average wind speed. In most areas, the nighttime wind direction frequency produces the most dominant average annual direction. The average annual wind speed is 4 miles per second (8.9 miles per hour) (WRCC 2001).

4.3.3.1 Nonradiological Releases

SNL/NM is in the Albuquerque Middle Rio Grande Intrastate Air Quality Control Region (#152) (40 CFR 81.83). The EPA has classified this region as better than national standards for sulfur dioxides; unclassifiable/attainment for ozone; unclassifiable for PM_{10}; unclassifiable or better than national standards for nitrogen dioxide; attainment (maintenance area) for carbon monoxide; and not designated for lead (40 CFR 81.332). The nearest Prevention of Significant Deterioration Class I area to SNL/NM is Bandelier National Monument, which is located 80 kilometers (50 miles) to the north-northeast.

The primary stationary sources of criteria pollutants are the steam plant boilers (which represent more than 90 percent of the total emissions of criteria pollutants), Building 862 generators, and the fire testing facilities located at the Lurance Canyon Burn Site. Other sources are spatially separated, thereby contributing minimal impacts. Emissions of hazardous chemical air pollutants include those from facilities that release chemicals to the atmosphere and from operations at the burn site.

The steam plant produces heat for buildings in TA-I and the eastern portion of KAFB. SNL/NM has four standby generators, each with a 600-kilowatt capacity. These diesel-fired generators are in TA-I, Building 862. The generators have a local air quality permit limiting operation to 500 hours per year per generator. They are started monthly for maintenance and testing, as well as during electrical power outages in TA-I. The fire testing facilities (Lurance Canyon Burn Site) include a number of open pools, the Smoke Emission Reduction Facility, and the Small Wind-Shielded Facility. The open pools emit directly to the atmosphere, while the two facilities are closed and emit through exhaust stacks. The fire testing facilities are used to test the response of shipping containers, aerospace components, and other items to high-temperature conditions. These facilities typically average 42 tests per year; each test lasts about 30 minutes, although some can last as long as 4 hours. Mobile sources (motor vehicles) are a major source of criteria pollutant emissions in and around SNL/NM. **Table 4–20** summarizes the emissions associated with these facilities for 1996, as well as volatile organic compound and hazardous air pollutant emissions from the entire site.

Table 4–20 Estimated Air Emissions from Stationary Sources at SNL/NM in 1996

Pollutant	*1996 Emissions (metric tons per year)*
Carbon monoxide	13.8
Nitrogen oxides	140
PM_{10}	3.31
Sulfur dioxide	0.29
Volatile organic compounds	3.69
Hazardous air pollutants	2.2

PM_{10} = Particulate matter less than or equal to 10 microns in aerodynamic diameter.
Source: DOE 1999f.

Volatile organic compound and hazardous air pollutant emissions also come from laboratories, miscellaneous chemical operations, and the fire testing facilities. Chemical uses and the corresponding emissions occur in

each TA and in the outlying test areas. In 1996, hazardous air pollutant emissions associated with chemical users were 2.2 metric tons (2.4 tons). Volatile organic compound emissions for 1996 were approximately 3.7 metric tons (4.07 tons).

Few industrial emission sources exist in the region. Primary air pollutant emissions in the region result from using motor vehicles, the seasonal use of wood-burning stoves and fireplaces, and open burning activities.

Air quality for SNL/NM is governed by regulations promulgated locally by the Albuquerque/Bernalillo County Air Quality Control Board and federally by the EPA. The EPA has delegated authority for regulating sources under the Clean Air Act to the State of New Mexico. In turn, the State of New Mexico has delegated authority for regulating sources to the Control Board, located in Bernalillo County.

The Albuquerque/Bernalillo County Air Quality Control Board promulgates regulations in 20 New Mexico Administrative Code 11 for compliance with the Clean Air Act, as well as applicable state and local air quality requirements. The Albuquerque Environmental Health Department Air Quality Division administers the regulations promulgated by the Control Board. The New Mexico Environmental Improvement Board has established ambient air quality standards (20 New Mexico Administrative Code 2.3) that are generally more stringent than the Federal standards and that incorporate additional standards for hydrogen sulfide and total reduced sulfur. In addition to the criteria pollutants provisions, the EPA established in 40 CFR Part 61 the National Emission Standards for Hazardous Air Pollutants (NESHAP) and Title III of the 1990 Clean Air Act Amendments, which define hazardous air pollutants. The primary nonradiological pollutants considered in this EIS are criteria pollutants and hazardous air pollutants. Hazardous air pollutants include the 188 hazardous air pollutants defined by the EPA in Title III of the Clean Air Act. Also included are other potentially toxic chemical air pollutants for which occupational exposure limits have been defined by various organizations, including those chemicals categorized as volatile organic compounds (any organic compound that participates in atmospheric photochemical reactions except those designated by the EPA administrator as having negligible photochemical reactivity). Only those hazardous air pollutants that would be of concern for any alternatives at this site are discussed here.

Monitoring stations throughout the Albuquerque Basin are operated by the Albuquerque Environmental Health Department and the New Mexico Environment Department to measure criteria pollutants, including carbon monoxide, nitrogen dioxide, PM_{10}, and ozone. These monitoring stations do not measure lead or sulfur dioxide. An additional station, the Criteria Pollutant Monitoring Station located in TA-I, measures lead and sulfur dioxide.

In addition to regional ambient air quality monitoring for criteria pollutants, SNL/NM operates six onsite monitoring stations for PM_{10}. Monitoring results indicate that sampling locations closer to the most populated areas of SNL/NM generally reveal higher PM_{10} concentrations. In addition, PM_{10} concentrations generally increase during the windy season due to blowing soil particles. Additional information on criteria pollutant concentrations at monitoring stations in TA-I is presented in the *SNL/NM SWEIS* and the *1999 Annual Site Environmental Report*, *Sandia National Laboratories, New Mexico* (SNL/NM 2001b). Measurements at these stations include contributions of criteria pollutants from the nearby SNL/NM emission sources. **Table 4–21** compares air pollutant concentrations which are considered to be representative of background conditions near SNL/NM to applicable Federal (40 CFR Part 50) and state (20 New Mexico Administrative Code 2.3) standards for each pollutant. These values include monitoring data in the Albuquerque Basin during 1999 and particulate matter values recommended by the state agency. Monitoring data in the Albuquerque Basin and at monitors within the SNL/NM in some cases show higher values. Air quality standards were not exceeded in 1999 in the Albuquerque Basin, except the PM_{10} standards were exceeded at one onsite monitor where values of 50.6 micrograms per cubic meter, annual average, and 188 micrograms per cubic meter, 24-hour average were reported. Onsite concentrations were

all below threshold standards. Maximum onsite PM_{10} concentrations were 16.6 and 66 micrograms per cubic meter for annual and 24-hour averaging at the KUPM monitor northwest of TA-V (SNL/NM 2001b, EPA 2001).

Table 4–21 Comparison of Background Ambient Air Concentrations With Applicable National and New Mexico Ambient Air Quality Standards [a]

Pollutant	*Averaging Period*	*Most Stringent Standard [b] (micrograms per cubic meter)*	*Maximum Ambient Air Concentration (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	8,280 12,500	4,660 [c] 5,520 [c]
Lead	Quarterly	1.5	0.002 [d]
Nitrogen dioxide	Annual 24 hours	78.1 156	26.1 [e] 46 [e]
Ozone	1 hour	196	145 [f]
PM_{10}	Annual 24 hours	50 150	30 [g] 30 [g]
Sulfur dioxide	Annual 24 hours 3 hours	43.5 217 1,090	0.12 [h] 1.7 [h] 13.5 [h]
Total suspended particulates	Annual 24 hours	60 150	30 30

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter.

[a] New Mexico also has ambient standards for total reduced sulfur and hydrogen sulfide. There is no monitoring data for these compounds and they are not pollutants of concern at SNL/NM.

[b] The more stringent of NAAQS and the state standard. The annual standards are not to be exceeded. Short-term standards may be exceeded, generally once, before a violation must be reported. The preamble of the state regulation (Section 108) allows excesses over short periods of time due to unusual meteorological conditions. Standards and monitored values for pollutants other than particulate matter are stated in parts per million (ppm). These values have been converted to micrograms per cubic meter ($\mu g/m^3$) with appropriate corrections for temperature (21 °C [70 °F]) and pressure (elevation 5,400 feet) following New Mexico dispersion modeling guidelines (revised 1998) (NMAQB 1998).

[c] 1999 maximum background concentrations from monitoring stations 350011003-1 or 350010023-1.

[d] 1999 maximum background concentration at onsite monitoring station (CPMS).

[e] 1999 annual concentration at Albuquerque monitor (350010023-1) 25 micrograms per cubic meter plus contribution from the Cobisa Power Plant (1.1 micrograms per cubic meter) (DOE 1999f).

[f] Highest 1-hour ozone monitoring value at the CPMS site in 1999.

[g] Background PM_{10} values for 24-hour and annual PM_{10} cumulative impacts from NMAPCB (DOE 1999f).

[h] Background concentrations resulting from operation of the Cobisa Power Plant (DOE 1999f).

Source: DOE 1999f, EPA 2001, SNL/NM 2001b.

The ambient air concentrations attributable to sources at SNL/NM are presented in **Table 4–22**. These concentrations are based on the No Action concentrations presented in the *SNL/NM SWEIS* and include the contribution from the Cobisa Power Station and the various small sources expected to be operational by 2008. These concentrations are used as the baseline concentration from SNL/NM activities in the cumulative analysis (Section 5.3.14). These concentrations, when combined with background concentrations, (Section 5.3.14) are below the ambient air quality standards. Concentrations of hazardous and toxic compounds are below regulatory standards and human health guidelines as described in the *SNL/NM SWEIS*.

Table 4–22 Modeled Ambient Air Concentrations from SNL/NM Sources

Pollutant	*Averaging Period*	*Most Stringent Standard [a] (micrograms per cubic meter)*	*Concentration [b] (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	8,280 [c] 12,500 [c]	78.4 119
Nitrogen dioxide	Annual 24 hours	78.1 [c] 156 [d]	10 103.7
Ozone	1 hour	196 [e]	(f)
PM_{10}	Annual 24 hours	50 [c] 150 [c]	11.4 114.2
Sulfur dioxide	Annual 24 hours 3 hours	43.5 [c] 217 [c] 1,090 [c]	1.7 12.2 21.1
Total suspended particulates	Annual 24 hours	60 [c] 150 [c]	11.4 114

[a] The more stringent of the Federal and state standards is presented if both exist for the averaging period. NAAQS (40 CFR Part 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic PM_{10} mean standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

[b] Concentrations are based on No Action modeled concentrations presented in the *SNL/NM SWEIS* (DOE 1999f), which occur at a receptor at the National Atomic Museum outside the SNL/NM fence line.

[c] Federal and state standard.

[d] State standard.

[e] Federal 8-hour standard is currently under litigation.

[f] Not directly emitted or monitored by the site.

PM_{10} = Particulate matter less than or equal to 10 microns in aerodynamic diameter.

Note: NAAQS also include standards for lead. No sources of lead emissions have been identified for any alternative evaluated. Emissions of hazardous air pollutants not listed here have been identified at SNL/NM, but are not associated with any of the alternatives evaluated. The EPA revised the ambient air quality standards for particulate matter and ozone in 1997 (62 FR 38856, 62 FR 38652); however, these standards are currently under litigation, but could become enforceable during the life of this project.

Sources: 40 CFR Part 50; DOE 1999f.

4.3.3.2 Radiological Releases

In 1999, the highest activities found in SNL/NM's atmospheric emissions were primarily the result of argon and tritium. These radionuclides generally have been the most significant releases over the past 10 years. The major radionuclide species and curies released from SNL/NM are listed in **Table 4–23**. There was a total of 17 point sources and 3 diffuse sources (landfills) listed in the 1999 NESHAP report; 4 of 20 facilities reported zero emissions.

There are three NESHAP sources in TA-V. Two facilities had reportable NESHAP emissions in 1999. One, the Annular Core Research Reactor, is used to perform in-pile experiments for severe reactor accident research projects. In 1997, the configuration was converted to support the Medical Isotope Production Project, which will produce radiopharmaceuticals. Argon-41, an air activation product, was the only radionuclide released from this source in 1999. The second source is the Sandia Pulsed Reactor, which is used to produce intense neutron bursts for effects testing on materials and electronics. This reactor also emitted only argon-41 in 1999. There were no releases from the Hot Cell Facility (the third source) in 1999. This facility provides full capability to remotely handle and analyze radioactive materials such as irradiated targets.

Table 4–23 Radiological Airborne Releases to the Environment at SNL/NM in 1999[a]

Source	*Technical Area*	*Radionuclide*	*Release (curies)*
Sandia Pulsed Reactor, Building 6590	TA-V	Argon-41	2.30
Annular Core Research Reactor, Building 6588	TA-V	Argon-41	2.99
High-Energy Radioactive Megavolt Electron Source, Building 970	TA-IV	Nitrogen-13	4.08×10^{-4}
Mixed Waste Landfill (diffuse emissions)	TA-III	Tritium (Hydrogen-3)	0.294
Radioactive and Mixed Waste Management Facility, Building 6920	TA-III	Tritium	0.6
Chemical Waste Landfill (diffuse emissions)	TA-III, South	Uranium-238	2.52×10^{-6}
Explosives Components Facility, Building 905	TA-II	Tritium	5.05×10^{-4}
Cleaning and Contamination Central Laboratory, Building 897	TA-I	Carbon-14	3.5×10^{-5}
Neutron Generator Facility, Building 870 - East Annex - North Wing Tritium Envelope	TA-I	 Tritium Tritium	 0.08 2.7
TANDEM Accelerator, Building 884	TA-I	Tritium Nitrogen-13 Fluorine-18	1×10^{-6} 1.85×10^{-5} 1.69×10^{-6}
Radiation Laboratory, Building 827	TA-I	Tritium	1×10^{-5}
Calibration Laboratory, Building 869	TA-I	Tritium	2.6×10^{-5}

[a] Radionuclides with half-lives less than about 10 minutes are not included in the table. Also not included are radionuclides for which less than 10^{-6} curies are released per year. Refer to SNL/NM 2001b for the complete list of airborne releases.

Source: SNL/NM 2001b.

4.3.4 Noise

Baseline sounds at SNL/NM consist of noise generated in and around the surrounding area, mainly from transportation and stationary sources. Activities at and around SNL/NM affect ambient (background) sound. These include aircraft associated with Albuquerque International Sunport and KAFB, vehicular traffic at KAFB, and industrial sources. SNL/NM test programs, including tests of high explosives, rocket motors, and large-caliber weapons and tests producing sonic booms, contribute to the noise baseline. Other noise sources at SNL/NM include industrial and construction activities.

Noise effects to the community depend on the loudness of the sound, the intensity of vibrations, the frequency of the events, and the atmospheric conditions transmitting sound during the event. In most cases, the impulse sound heard outside KAFB resembles a dull thud or a short burst (less than three seconds). The noise baseline (aircraft, traffic, and industrial sources) would mask the sounds produced by most SNL/NM activities.

SNL/NM's ambient background sounds will be relatively consistent. Background sounds produced by generators, air conditioning, ventilation systems, vehicles, and employee activities constitute a substantial sound source during the morning, midday, and evening. The range of background noise levels associated with these sources is from 50 to 70 dBA (day-night average sound level).

SNL/NM testing produces the most perceptible impulse sound levels at TA-III, Coyote Test Field, and other outdoor test facilities. The 1996 baseline frequency of impulse noise events is 1,059 events. Only a small fraction of these events are loud enough to be heard or felt beyond the site boundary. No residential areas on KAFB or in the city of Albuquerque are affected by vibrations expected to be damaging or annoying.

SNL/NM is subject to aircraft noise from the Albuquerque International Sunport and KAFB and from vehicular traffic on KAFB. Aircraft noise is the most prevalent sound because Runway 8-26 is the primary runway for the Albuquerque International Sunport. Aircraft take off and land in an easterly direction on this runway about 75 to 80 percent of the time. Aircraft using this runway fly directly over SNL/NM. Noise abatement procedures to decrease aircraft noise in nearby neighborhoods, such as Ridgecrest and Four Hills, affect SNL/NM. These procedures direct pilots to avoid these neighborhoods by flying over SNL/NM.

Based on Federal Aviation Administration land use compatibility guidelines, adverse effects on people are most likely to occur within the 75-dBA day-night average noise-level area. At the Albuquerque International Sunport, the 65- and 70-dBA noise levels extend beyond the Sunport boundary with KAFB, but not the 75-dBA noise level.

The Air Force Research Laboratory, U.S. Air Force/Explosive Ordnance Disposal, and the Defense Special Weapons Agency detonate explosives on KAFB, and non-SNL/NM agencies perform noise-producing activities at SNL/NM. These activities and the potential for conflicts with land uses are discussed in the *SNL/NM SWEIS*. Motor vehicle noise is prevalent in the more congested areas of KAFB.

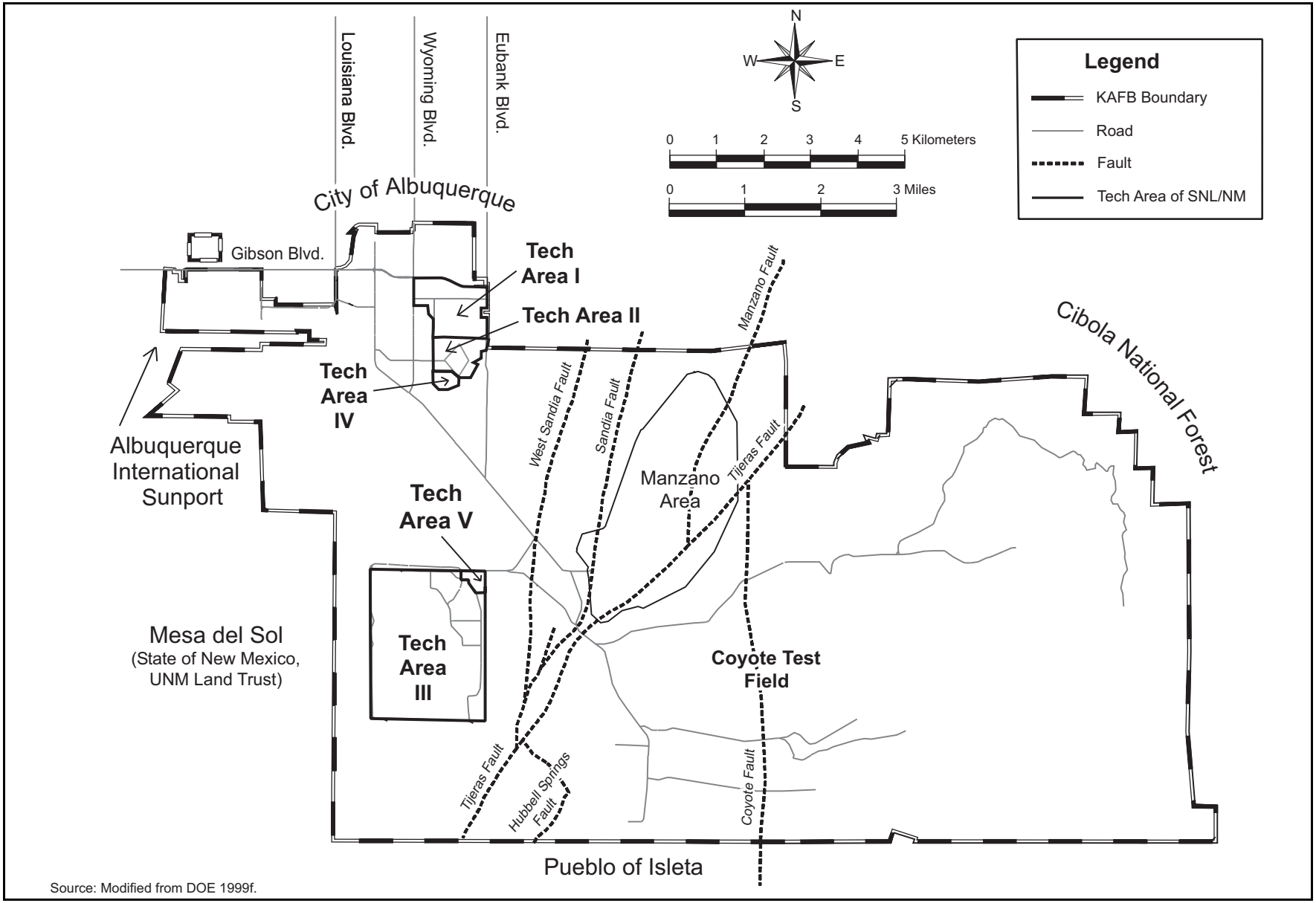
The adjoining city of Albuquerque limits sound levels as specified in its Noise Control Ordinance, although this ordinance is not applicable to KAFB. The limitation on noise levels at a residential property line is 55 dBA during the day and 50 dBA at night. Limits are also specified for commercial and industrial properties (City of Albuquerque 2001).

4.3.5 Geology and Soils

SNL/NM is located on the east-central boundary of the 48- by 145-kilometers long (30- by 90-miles long), north-south trending Albuquerque-Belen Basin (SNL/NM 1993). This basin lies within the extensive Rio Grande rift zone (as further described in Section 4.2.5) and the Basin and Range Physiographic Province. KAFB is bordered to the east by the Manzanita Mountains and to the northeast by the Sandia Mountains. The strata beneath the western most portion of KAFB, where the SNL/NM TAs are located, consists primarily of gravels, sands, silts, and clays ranging in age from Quaternary to Miocene (recent to 24 million years old). These consist of alluvium deposited by the ancestral Rio Grande that overlie alluvial fan deposits derived from erosion of the mountains to the east. Immediately overlying the Sante Fe Group across portions of SNL/NM, south of Tijeras Arroyo, is the Ortiz Gravel which is a discontinuous unit with a thickness ranging from 0 to 46 meters (0 to 150 feet) (SNL/NM 1993). The Sante Fe Group is the primary basin-fill material and mainly is composed of unconsolidated sediments (e.g., gravel, sand, silt, clay, and caliche) in the Albuquerque-Belen Basin. The basin-fill deposits and the Sante Fe Group are in turn underlain by Precambrian age (more than 570 million years old) crystalline and Paleozoic age (245 to 570 million years old) marine carbonate bedrock, which also compose the mountains to the east of KAFB (SNL/NM 1993). Additional details about SNL/NM site geology are presented in the *SNL/NM SWEIS*.

Extensive nonmetallic mineral deposits exist in the area in the form of aggregate rock, sand, silt, and clay as components of the basin-fill deposits which underlie KAFB. The potential for metallic mineral deposits also exists within the older bedrock located to the west of the site, as well as placer deposits within the alluvial and colluvial sediments. Evidence of historic placer mining has been identified throughout KAFB as a result of cultural resource surveys.

A number of regional faults cross KAFB just to the east of SNL/NM (Sandia, West Sandia, Manzano, Hubbell Springs, Tijeras, and Coyote Faults) (see **Figure 4–14**). There is no evidence of movement along these faults over the last 10,000 years. Although not active, a determination has not been made as to whether any of these faults should be considered "capable." A capable fault is one that has had movement at or near



Source: Modified from DOE 1999f.

Figure 4–14 Regional Faults at KAFB and SNL/NM

the ground surface at least once within the past 35,000 years or recurrent movement within the past 50,000 years (10 CFR 100, Appendix A).

KAFB and SNL/NM are located in a region with relatively moderate to high seismicity. Modified Mercalli Intensities of up to VII have been reported (DOE 1996f). Over the last 100 years, only three earthquakes have reportedly caused damage in Albuquerque (DOE 1996f). Since 1966, New Mexico has experienced four moderate earthquakes, all approximately magnitude 5 on the Richter scale. Two of these were in Dulce (near the Colorado border in north-central New Mexico), one was in Gallup (near the Arizona border in west-central New Mexico), and one was in Eunice (extreme southeast corner of New Mexico, near the Texas border). The closest of these (Dulce and Gallup earthquakes) were epicentered about 200 kilometers (125 miles) from the site. The largest earthquake experienced in the Albuquerque area occurred on January 4, 1971, and measured magnitude 4.7. There was no appreciable damage to SNL/NM buildings, although some cracks were noted that could have predated the earthquake. This event had a reported Modified Mercalli Intensity of VI at its epicenter, which was located some 12 kilometers (7.4 miles) north-northwest of SNL/NM, as measured from TA-V. Within a radius of 100 kilometers (62 miles) of SNL/NM, a total of 14 significant earthquakes (i.e., having a magnitude of at least 4.5 or a Modified Mercalli Intensity of VI or larger) have been documented, with none centered closer than the January 1971 event (USGS 2001c). Since 1973, 37 earthquakes have been recorded within 100 kilometers (62 miles) of SNL/NM ranging in magnitude from 1.6 to a magnitude 4.8 event in January 1990. The closest of these minor-to-light earthquakes was a July 1985 1.6-magnitude event that was reportedly felt and centered about 6 kilometers (3.7 miles) north of TA-V within KAFB boundaries. All but a few of the remaining 37 earthquakes had epicenters greater than 60 kilometers (37 miles) away. The most recent was a Richter magnitude 4 earthquake that occurred in January 1998 at a distance of 58 kilometers (36 miles) from the site (USGS 2001d).

A nondamaging earthquake producing a Modified Mercalli Intensity of less than III is predicted to have an annual probability of occurrence of 1 in 2 (i.e., once every 2 years) and a damaging event has a probability of 1 in 100 (i.e., once every 100 years) (DOE 1996f). For reference, a comparison of Modified Mercalli Intensity (the observed effects of earthquakes) with measures of earthquake magnitude and ground acceleration is provided in Section F.5.2 (see Appendix F).

As discussed in more detail in Section 4.2.5, the U.S. Geological Survey has developed new earthquake hazard maps that are based on spectral response acceleration. These maps have been adapted for use in the new International Building Code (ICC 2000) and depict maximum considered earthquake ground motion of 0.2- and 1-second spectral response acceleration, respectively, based on a 2 percent probability of exceedance in 50 years (i.e., 1 in 2,500). SNL/NM is calculated to lie within the 0.61g to 0.62g mapping contours for a 0.2-second spectral response acceleration and the 0.17g to 0.18g contours for a 1-second spectral response acceleration. For comparison, the calculated peak ground acceleration for the given probability of exceedance is approximately 0.27g (USGS 2001e).

The potential for future damaging volcanic activity at SNL/NM and the vicinity is considered to be low (DOE 1996f). As for other geologic hazards, slope instability is a concern on steeper slopes such as along water-cut drainages and on mountain slopes to the east of the SNL/NM TAs in the Manzanita Mountains. However, most SNL/NM facilities are constructed on level ground or on the gentle slopes of alluvial fan sediments.

Several soil associations occur across KAFB and are derived primarily from materials eroded from the nearby mountains and deposited as alluvial fans. These include the Bluepoint-Kokan, Madurez-Wink, Tijeras-Embudo, Kolob-Rock outcrop, and Seis-Orthids associations, with the Kolob-Rock outcrop confined to the eastern portion of the site. These soils are moderately to very steep, well-drained, loamy, and stony soils and include basalt, sandstone, and limestone outcrops. The remainder of the soils are generally well